PUBLIC WORKS

Deep cut with and without sheeting and bracing, in the San Fernando Valley, Los Angeles, trunk sewer. (See Page 9.)

FEBRUARY, 1933

VOL. 64 No. 2
Entered as second-class matter at the Post Office at New York, N. Y., Sept. 1, 1922, under the Act of March 3, 1879.
Published Monthly by PUBLIC WORKS JOURNAL CORPORATION, 310 East 45th St., New York, N. Y.
FEBRUARY, 1933

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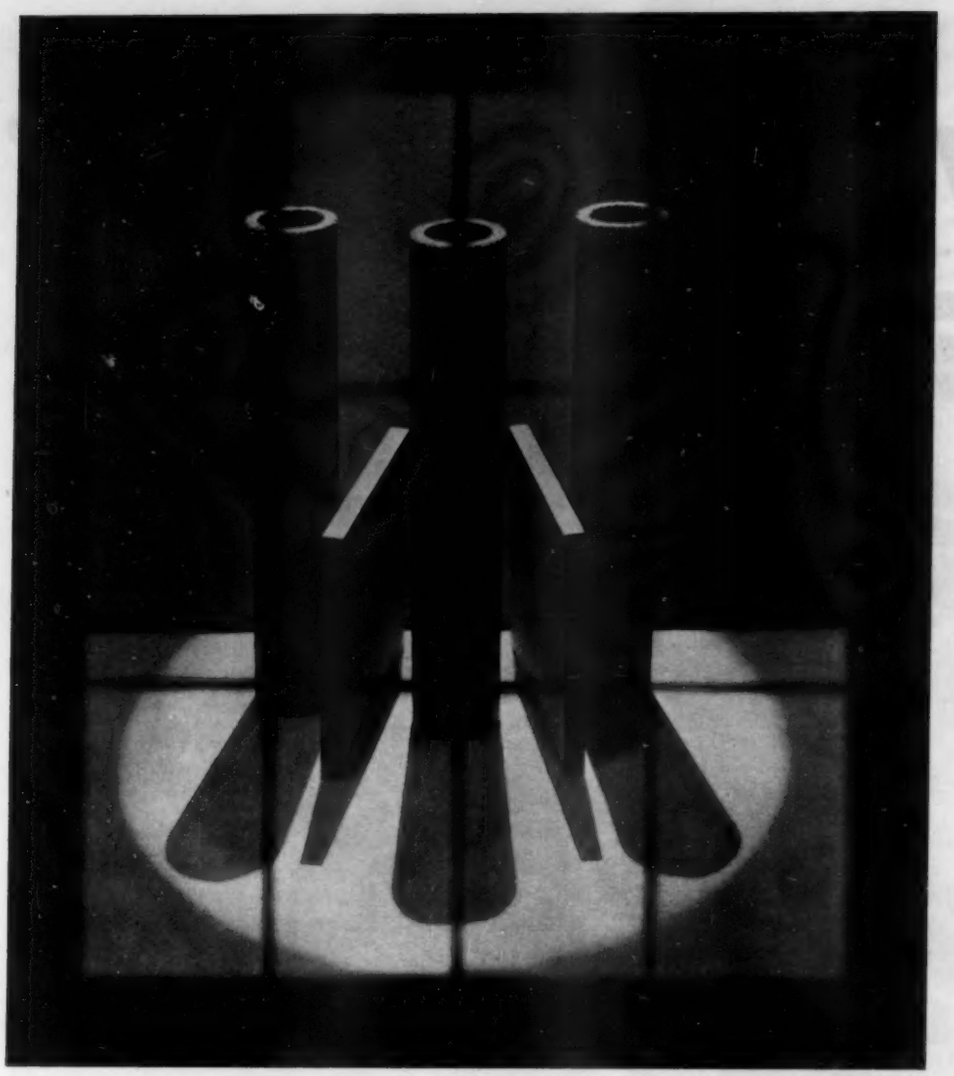

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An Engineering and Construction Journal

City County State

VOL. 64 FEBRUARY, 1933 No. 2

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Founded in 1896

A. PRESCOTT FOLWELL, *Editor*

Published Monthly at 310 East 45th St. New York, N. Y.

SUMNER N. HUME, *New York, N. Y.*
JOSEPH E. O'CONNOR, *Chicago, Ill.*

Western Office: 122 South Michigan Ave., Chicago

SUBSCRIPTION RATES:

United States and Possessions, Mexico and Cuba $3.00
All other countries, $4.00. Single Copies, 35 cents each.

BRAINTEASERS

The Spider's Web

For our fans who enjoy delving in theoretical mathematics we have a (seemingly) simple question. Spiders spin their webs most methodically and have been known to become completely "nettled" when unforeseen circumstances interfere with the orderly procedure of constructing what still are probably the world's best fly-traps. The villain of this piece was even more systematic than his clansmen usually are. (Is it the male or the female who spins a web, or perchance do they both spin webs? For the sake of our problem it's a he.) His web consisted of four concentric octagons through the corners of which passed eight radial strands meeting in the center, at which point he sat. While waiting for his next meal, he devoted considerable mental energy to planning his campaign of attack. So busy was he with his thoughts that when a fly did alight on the web at one of the web junctions, his plan had not yet been determined, and so, to all intents and purposes, the fly was safe. The question which absorbed the spider was "In how many different ways can I travel over the strands to the fly without travelling over an intersection more than once on any one trip?" (Is it remarkable that the fly escaped?)

Mikey and Ikey

And now for the practical computers. Mikey is the brick-layer and Ikey the hod-carrier. When they started work in the morning Mikey found that Ikey had some bricks all ready on the scaffold. After an hour had passed there were still some of these bricks unlaid. Then Ikey had a stroke of ambition and brought up twice as many bricks as were unlaid, and in the next hour Mikey laid exactly as many bricks as in the first hour. Then Ikey added three times as many bricks as he found on the scaffold and in the next hour Mikey again laid his usual number of bricks. Then Ikey added four times as many bricks as were left and again Mikey repeated his hourly rate of brick laying. Ikey then added five times as many bricks as were left, but now Mikey resolved to show what he could do, and in the next hour laid as many bricks as he had previously laid since beginning for the day. How many bricks did Mikey lay in this last hour? On the Q.T., he laid as few as possible during each of the other hours.

Solutions

All those who obtained 26.033 feet for the spacing of the posts in last month's problem, arrived at the correct solution. Others had better review their figures. The division problem is

$$10020316 \div 124 = 80809$$

Let's see how many can keep up a batting average of 1000 for 1933 . . . . and Oh, for a St. Patrick's Day problem as good as last year's. Who will match Mr. Steinman's gem?

Winners

We've had to revise our offer made in the December issue for solutions to the sandwich problem. There was so little choice between the best three solutions that two-year subscriptions are herewith given to Mr. Hoops, Ohio; Mr. Besozzi, Ind.; and Mr. Wheeler, N. H. These and other winners have been notified. We thank them all for their interest.

Methods of solving the January problems will be sent on request.

BENJAMIN EISNER

For latest catalogs—consult the *classified* INDUSTRIAL LITERATURE section, beginning on page 47

PUBLIC WORKS

City, County and State Engineering and Construction

Vol. 64 *February, 1933* No. 2

Completing the Longest Continuous Gravity Sewer in the United States

By S. S. Ball

District Sewer Design Engineer, Los Angeles

THE city of Los Angeles, Calif., has just completed construction of a trunk sewer which, combined with that previously laid, gives a continuous gravity line about 80 miles long—probably the longest gravity sewer in the United States. It extends approximately east from the ocean outfall near El Segundo to the San Fernando valley, then north up this valley, draining an area of about 200 square miles with a present population of about 80,000.

The completion of this sewer was necessary for the development of the valley; even the temporary provision for sanitation furnished by cesspools was not satisfactorily practicable in the foothills of the surrounding mountains, because of the adobe and rock formation, nor in the valley because the ground water is only about 6 feet below the surface. Moreover, this underground water is drawn upon for the public water supply during dry months and would be polluted by cesspools.

The North Outfall Sewer, which drains this valley, was begun in 1923, with the construction of the ocean outfall, the Hyperion screening plant and the trunk sewer, of which about 52 miles had been completed by 1926. The cost—$10,000,000—was provided by a city-wide bond issue and by funds paid by various adjacent municipalities for the privilege of discharging their sewage into this sewer. As construction cost was below the estimate, a considerable sum remained and $470,000 was used for further extension of the trunk sewer as far as North Hollywood.

Sections not served by the sewer appealed for extension, by assessment on the benefited territory if public funds were not available, and in 1929 the city engineer

Curve in 54-inch pipe. Foreground: Removing forms from finished pipe. Background: Clay liners in place on form, ready to receive concrete.

was directed to prepare the necessary plans for relieving an area of approximately 151 square miles, the cost of which was estimated at $1,250,000. The cost could be assessed under either of two plans; but both presented objectionable features, and in 1930 it was found that public funds might be available and the assessment idea was abandoned. Plans for five miles were revised and the work let in two contracts, each for 2½ miles, for $203,634 and $171,800 respectively.

This left ten miles still to be constructed. Funds could not be raised to carry out the original plans which provided for an estimated growth for 25 years to come, requiring a sewer 51 to 21 inches diameter. But the demand for drainage was pressing, and it was decided to change the plans to diameters of 24 to 15 inches, which it was calculated would provide relief for the wet areas for at least 10 years to come. This ten miles was let in four contracts, the last in May, 1932, for a total of $175,250.

Engineering Features

In designing the sewer, a map with 5-foot contours was prepared from U. S. Geological Survey maps and drainage maps with a scale of 1 in. = 400 ft. On this

Trench with open sheathing. In background, pouring concrete

Ten-foot brick transition from 57" to 39" sewer. "Log cabin" manhole

Tile lining blocks in place, ready for outside forms

map interceptors were laid out and their respective tributary areas carefully outlined, and on each of these were shown the industrial, business and residential zones as proposed by the city planning commission. Using a standard coefficient, in units of second-feet per acre, for each class of zone, the anticipated sewage was calculated for each interceptor district, and the trunk sewer calculated to receive these amounts where the several interceptors joined it. This calculation was checked by an anticipated population estimate made by the Central Sanitary Sewer Division.

The slopes of the valley floor definitely located the trunk sewer as close to the river as possible. Following available rights of way and the designated minimum grade of the sewer, the route was carried easterly until the depth reached about 28 feet (the eastwardly slope of the ground surface being flatter than this grade), then south until it reached the minimum depth of about 8 feet, then east again, etc.; always keeping the sewer deep enough to serve the entire area. Elevations at critical points were then fixed exactly by reference to profile surveys run over the routes of the trunk and interceptor sewers.

A detailed investigation of soil conditions along the entire length of the proposed sewer was then made. Test holes 6 inches in diameter were drilled to subgrade depth at half-mile intervals. These gave the depth to ground water accurately, but to obtain more complete data concerning class of material, holes 30 inches in diameter were drilled half way between the 6-inch holes. An accurate log was kept of each hole and samples taken. Later, glass tubes were filled with materials from these samples in such a way that an exact replica of each test hole was reproduced to a vertical scale of ½ inch to the foot. A profile of the sewer, vertical scale ½ inch to the foot and horizontal scale 1 inch to 400 feet, was mounted on a large board, and the glass tube replica of each hole was placed at the location of that hole on the profile and at the proper grade and fastened there. The water level at each hole also was indicated on the profile. This board was kept on exhibition at the city hall, to give bidders information concerning the depth of water and classes of material to be excavated, as well as the depth of the sewer.

The plans for the first two sections provided for two alternate types of sewer which past experience had proved to be the most satisfactory and economical—pre-cast circular reinforced concrete pipe, and monolithic semi-elliptical reinforced concrete. Since quantities of gas were anticipated, each type was to be lined with vitrified clay blocks over the upper ¾ of the circumference. The sewer varied in size from 36-inch to 57-inch. The lowest bid on each section was for semi-elliptical concrete built in place, and these were accepted; Section A being awarded to Dalmatin and Nikcevich at $203,634; and Section B to Martin Simunovich at $171,800.

The lower part of Section A was in dry, firm soil and was excavated with a drag-line to the most economical depth and finished to full depth with a clam-shell. No bracing was used, but the sides of the trench were allowed to assume their natural slope, occupying the full width of the street. After about a half-mile of this, water and unstable sand were encountered for the remainder of the section, and here the upper 8 to 12 feet was removed by an Austin excavator and sheeting driven to grade immediately behind the trencher shields. The rest of the trench was then excavated with a clam-shell.

The invert and arch were built in sections. All curves, where possible, had 100-ft. radii and were built on chords 10 feet long.

All of Section B was in dry, firm soil, and excavation was performed with a trenching machine and only a small amount of bracing was necessary. Both sections were built in eleven or twelve months.

Section C, consisting of 2.5 miles of 18", 21" and 24" centrifugally cast concrete pipe laid at an average depth of 18 feet, was let to the Martin Construction Co. for $44,390. No difficulties were encountered.

Section D, 18" and 21" vitrified clay pipe, average depth 21 feet, with some ground water, was let to R. A. Watson for $50,990. About three thousand feet which varied from 24 to 32 feet deep was skipped temporarily in order to complete all the shallower sections before changing to the longer trench excavator boom. This section was completed in five or six months.

(Continued on page 41)

Speed and Excellence on a 25-Mile Bituminous Resurfacing Job

THE longest resurfacing job that has been let in Ohio was completed December 1st, when the Wesco Company, of Chattanooga, Tenn., completed widening 24.75 miles of a 16-foot road to 20 feet, laying wedge courses to correct excessive crown, and a base or binder course approximately 1½ inches thick, covered with a 1-inch top course. The work was done on U. S. Road 30-S (the Lincoln Highway) east of Lima.

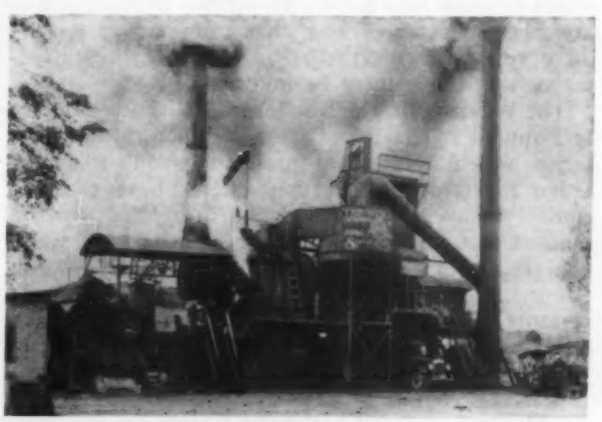
The 2-foot widening of each side was of concrete, the outer 9 inches of which was constructed as a curb. The 18.5 feet between curbs was paved with asphaltic concrete of the Ohio hot plant-mix specification T-5, a type of non-skid hot-mix surface first tried out by Ohio in 1931 and proving very satisfactory.

The asphaltic material needed—about 40,000 tons—was all turned out by a single plant set up at Lima, giving a maximum haul of approximately 26 miles. The hot stuff was delivered in 5-ton to 6-ton trucks. The plant was a West "Simplicity" asphalt plant, using a 2250-pound mixing box. The maximum amount laid in two 8-hour shifts was 940 tons.

The work was conducted in two 8-hour shifts for six days a week, except that toward the end, when there was a great deal of inclement weather, the seven-day week was used. Prior to the middle of Novembr a nine-inch fall of snow materially delayed the work, and this and rain caused a loss of four to six weeks of working time, so that the work was not completed until December 1st, when it had been planned to end before November 1st. When working under normal conditions without weather interference, the work progressed at approximately two miles of finished road in three days, the maximum speed having been one mile of 1-inch top in twelve hours.

The asphaltic material was spread on the road by two spreader boxes, into which the trucks dumped it; four men operating these boxes and assisting in the spreading. These were followed by a Lakewood finishing machine provided with special inside flanged wheels that rode on the concrete curbs, and with a new device known as a "compression strip dolly" which eliminates the necessity of carrying forward compression strips. This finisher was used for spreading the wedge courses, base course and top course. It was equipped with special high-speed gears giving a forward speed of 14 feet per minute, which speed the specifications allowed on the wedge and base courses; which was reduced to 10 feet for the top. Following the finisher were two back rakers and three 10-ton Buffalo-Springfield rollers. This gives a total of ten men, including the four who operated the finisher and rollers. These men spread, finished and rolled a maximum of 11,500 sq.-yds. of top in 12 hours. That they did not slight the work is indicated by the fact that on the first 8½ miles accepted by the engineer there were but seven bumps exceeding ¼-inch in a 10-foot length. Later, due to bad weather, the record was not quite so good.

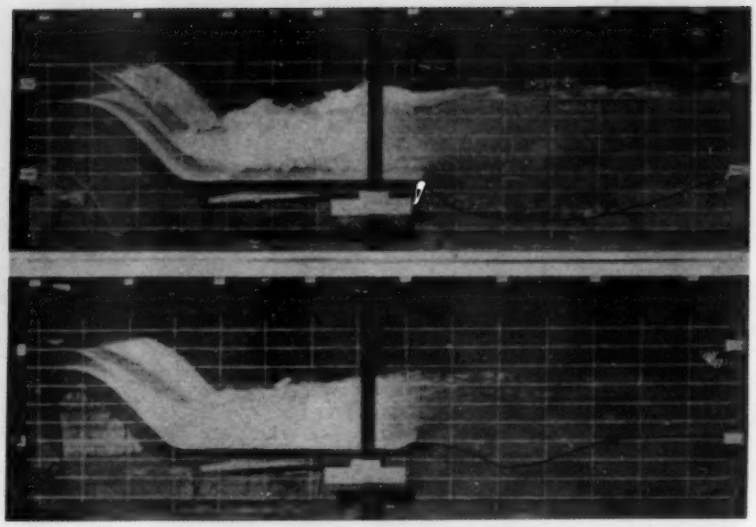
M. Russ was general superintendent of the work for the Wesco Company.

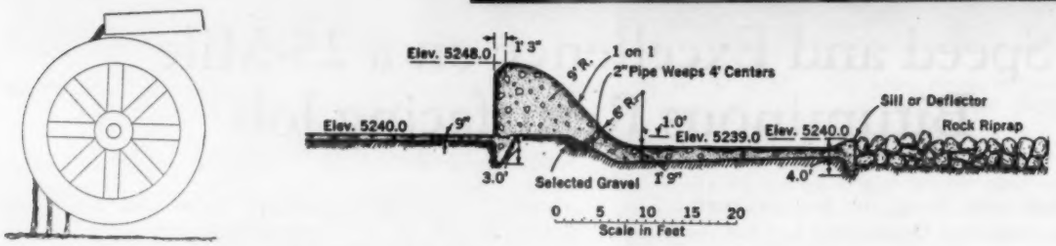


Plant at which all the "hot stuff" was mixed

THE WATER WHEEL

Following are the essential features of the important articles of the month having to do with water works design, construction and operation and water purification, arranged in easy reference form and condensed and interpreted. Published every month to include articles appearing during the preceding month.





Model under test without and with sill, and section of dam as built to correspond with the latter.

METEOROLOGICAL data furnished by the U. S. Weather Bureau are used widely by engineers, mainly precipitation, temperature, wind movement, and evaporation, it appears from a questionnaire sent to more than 200 members of the Am. Soc. of Civil Engineers by a research committee of that society.[42] The replies contained both favorable comments and criticisms on certain parts of the bureau's work. In general, the dissatisfaction expressed was in regard to the location of the stations at which observations are taken, the quality of the records, and the manner in which the data are published. The committee believes that much of the trouble can be eliminated by a complete reorganization of the bureau without materially increasing the cost of the work. It also recommends, among other things, "that a cooperative program be developed with other Federal departments, and with state, county and city agencies, railroad companies, and other public utilities, which program will allow an extension of stations into areas not now served" and "that a program of cooperative research with the many scientific institutions throughout the country be initiated."

The Weather Bureau's bulletins give daily, monthly and annual statements of the meteorological data collected, which are of great interest to waterworks men. Other government publications interesting to them include[24] many documents classified by the superintendent of documents as dealing with geology, water analysis, engineering, fishes, irrigation and water power, forestry, health, standards of weights and measures (including electrolysis and pipe corrosion), census publications, and topographical maps of the Geological Survey.

Material control is credited by the comptroller of the Hackensack, N. J., Water Co. with the following advantages:[40] Prevents losses through check of incoming material; eliminates waste by providing proper storage; prevents over-buying; aids standardization; insures having sufficient stock on hand; provides for perpetual inventory record; and aids properly recording material issued, and affords check of that received. Such a system involves six steps: Authority to make out purchase requisitions should be limited to as few persons as possible; purchasing should be centralized; checking against purchase orders of materials received in the store room or yard; proper storage of materials; proper system of issuing and transferring materials; taking frequent physical inventories.

Financing and accounting occupied a large part of the December issue of the A. W. W. A. Journal, about 110 pages in all. Different authors offer suggestions for increasing net revenue both by increasing gross income and by decreasing expenditures. Mr. Bankson divides[30] possible increase in volume of sales into four groups: Charges for services now rendered but not billed; reclaiming industrial water service lost through changes of industrial processing; lowering industrial rates for large consumers; increasing use by domestic consumers, as by encouraging gardening.

Under the first he lists under-registration of meters from lack of maintenance, or from over sizing; concerning the former of which, D. C. Morrow cited a case[37] where proper maintenance and repairs increased the revenue from every meter, some as much as 300%; testing of meters was recommended[2] and L. D. Gayton gave figures for Chicago[38] showing that meter registrations were increased 25% by replacing 3-inch meters with smaller ones.

For reducing expenditures, various suggestions were made, such as locating underground leaks[28], budgetary control of expenses[31], requiring guaranteeing of payment of water bills[39], and material control.[40]

Meter testing also received the attention of several engineers—its effect on revenues, [2 37 38] procedure of making tests.[29 58] Mr. Wilson states that, to determine with sufficient reliability what the performance of a meter will be over its range of capacity it is "necessary to make a test at each one of three different rates of flow," which rates "must be carefully chosen in order to show up the true form of the curve" (obtained by plotting percentage of water registered against the rate of flow).

Mr. Blomquist[29] believes from experience in Cedar Rapids that "a water meter will not change very materially in percentage of registration for about ten years"; but his city aims to check all small meters at least once in seven years, and 2-inch meters or larger once in two years. But in determining the interval between tests, consideration should be had of the effect on meters of the particular water used, experience with meters in the city in question, and degree of accuracy desired. He has "found that there is not a great deal of difference between the performances of several kinds of meters in our city"; but some meters that perform well there do not do so in cities using highly mineralized ground water.

"Progress in *water treatment* and filtration gives assurance that the ideal water is almost within the reach of nearly every municipality," says John R. Baylis.[60] "It will be water which is sparkling clear, free from bacteria, pleasing to the taste, so free from odors that those with the most sensitive olfactories cannot detect an odor, not very hard, and not corrosive to the distribution and household pipes. This is the kind of water the public desires, the kind for which they are willing to pay a fair price, and the kind they should have and eventually will demand."

Dam designing by study of models is becoming increasingly common and apparently justified the cost in the case of the Cochiti diversion dam[6], a concrete weir 8 ft. high and 235 ft. long across the Rio Grande. The ogee shape was adopted, and the impervious apron type of construction to produce the desired percolation factor of 10. The design of the apron to produce the jump and minimize scour below it was based upon experiments with ten different models on a 1:10 scale, with flat, dished and sloped aprons, with and without a sill at the end, and a floating apron. The models were tried out in a flume, one side of which was made of plate glass through which photographs were taken while water was passing over the models at rates varying up to the equivalent of 30,000 cu. ft. per sec. Among the conclusions reached were the following: Bucket-shaped or sloping aprons have no advantages. A sill at the lower end of the apron prevents scour immediately below it and helps produce the jump; but the sill should not be higher than necessary to produce a definite deflection of the lower water layers. (For this dam a triangular sill 12 in. high with a 2:1 upstream slope was adopted.) The position and shape of the jump are far more dependent on depth of tailwater on apron than on any other factor; a change of 0.1 ft. in this depth determined whether the jump occurred on or off the apron; 2 ft. depth is necessary for very small discharges, and to secure this the apron was lowered 1 ft. Baffles, corrugations, boulders, etc., are useless with high discharge.

Raising reservoir embankments was discussed in the Water Wheel last month. Raising masonry dams is believed by Mr. Burroughs[7] to be feasible and often desirable, and often attained by adding flashboards to the spillway crest, adding crest gates (preferably automatic in operation), or adding to the initial construction a concrete structure that will both reinforce the existing dam and carry the additional water load. Capacities have been increased up to 300% by the first two methods. Eleven instances of the third method, with both gravity and Ambursen-type dams, raising the height as much as 52 ft. in one case, are cited.

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c, Indicates construction article; *n*, note or short article *t*, technical article.

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1. Correcting Trouble with Customers' Services. H. W. Niemeyer and J. A. Bruhn, pp. 50-53.
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3. *n.* Pressure Tunnel under the First Narrows, Vancouver, B. C., pp. 15-18.
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6. *t.* Profile for a Low Dam (across the Rio Grande) Determined by Models. Albert W. Newcomer, pp. 9-13.
7. Initial and Final Dam Heights. (Stage Construction) E. H. Burroughs, pp. 14-16.
8. Mapping Montana's State Forests. (Watershed Protection) Omar W. White, pp. 17-20.
9. Preventing the Disintegration of Dams. Oren Reed, pp. 26-30.

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10. Arizona Publishes a Code for Guidance in Building Dams, pp. 771-772.

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15. Arch Dam Built in Isolated Blocks to Reduce Shrinkage Effects. F. A. Noetzli, pp. 78-79.

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17. Use of Non-Ferrous Service Pipes at Present Prices. Discussion by Messrs. Pracy, Gibson, Morris, Wiggin, Smith, pp. 1819-1827.
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23. Cement-Lined Cast Iron Pipe. Discussion by Messrs. Sweet, McDowell, Porzelius, Moore, pp. 1861-1866.
24. Useful Government Documents. A. F. Porzelius, pp. 1867-1869.
25. Inventory Methods for Yard Stocks. C. J. Alfke, pp. 1869-1874.
26. Organization of Water Departments for Emergencies. J. S. Dunwoody, pp. 1875-1880.
27. Making Water Works Properties Attractive. O. Z. Tyler, pp. 1880-1883.
28. Locating Underground Structures and Leaks. Discussion by Messrs. Patton, Gear, pp. 1883-1886.
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30. Relief from Downward Trend in Water Revenues. E. E. Bankson, pp. 1893-1903.
31. Budgetary Control of Expenses. E. C. Schwier, pp. 1904-1910.
32. Improvement Reserves for Leveling Financial Peaks and Valleys. V. Bernard Siems, pp. 1911-1921.
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52. Keeping Hydrants Ready. W. H. Henby, pp. 12-13, 32.
53. Reduction in Dam Construction Costs at Fairport, N. Y. James P. Wells, pp. 14-15.
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55. Formation and Revision of Water Rate Structures. Robert E. McDonnell, pp. 19-21.
56. Illegal Use of Water from Hydrants. Symposium, pp. 22-24.

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58. Importance of Testing Disc Meters at the Correct Rates of Flow. P. S. Wilson, pp. 6-8.
59. Water Treatment for Railway Systems. R. C. Bardwell, pp. 9-14.
60. The Future of Water Treatment and Filtration. John R. Baylis, pp. 27-29.
61. Double Pumping—To and From a Storage Reservoir. W. Compton Wills, pp. 32-33.

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Supporting a Sewer Across Unstable Ground

THE New Jersey State Highway Commission last year found it necessary to lay 600 feet of 42-inch storm sewer across ground where a 6-foot surface stratum of stable material was underlaid with about 20 feet of very soft, unstable peat muck having little supporting value. Sewers of 30-inch double-strength vitrified clay pipe previously laid across this material had settled as much as 18 inches in places, and many sections were found to be cracked and broken when excavated.

In looking for a plan to avoid such settlement, pile foundations were considered, but it was found that 25-foot piles would be necessary to reach a firm foundation under the peat. At the suggestion of Robert G. Blanchard, senior civil engineer of the commission, the method described below was adopted.

The pipe used was 18-foot lengths of 42-inch, 12-gage "Armco" paved invert pipe. This was much lighter than the vitrified pipe, and the longer lengths aided in preventing local settlements. Before lowering a length of pipe into the trench, a "U" bar of ⅝-inch metal was placed under the pipe, the two ends extending vertically about 3 feet above the top of the pipe, at intervals of 6 feet; a narrow semi-circular strip of corrugated metal being placed between the "U" bar and the pipe to help to stiffen the latter, this and the bar being held in place by wiring.

After the pipe had been laid, 6 x 8-inch creosoted timbers were placed across the trench at each "U" bar, the ends of the bar being slipped through holes previously bored in the timber. Each cross timber was supported at each end by two 3 x 12 x 36-inch creosoted bearing blocks or mud sills which in turn rested on the firm soil of the surface stratum. The ends of the "U" bars had been threaded, and by means of nuts they and the suspended pipe could be raised and the pipe brought accurately to grade.

A crew of a foreman and four men, using a powerful crane, laid this sewer at the rate of about 100 feet a day. The contractor, the P. Giovannone Construction Co. of River Edge, N. J., found this method much cheaper and more quickly carried out than timber piling foundation. The weight of the sewer, it is seen, is carried by the 6-foot firm stratum, and, so far as can be determined, the sewer has remained true to line and grade.

For this description and the illustration we are indebted to the "Highway Magazine."

Placing cross-timbers on bearing blocks and bringing pipe to grade by means of nuts on "U" bars.

Filing System for a City Engineering Office

By Benjamin Eisner
Of Taylor & Eisner, Consulting Engineers, Newark, N. J.

FILING difficulties in the smaller offices result from the diversity of purpose and character of the data to be filed. If only letters or only maps require indexing and classification, filing is a relatively simple procedure. Instead of simple documents, there are all manner of items which must be readily available for reference. Files must contain maps, reports, text books, news clippings and many other kinds of documents referring to totally different projects and fields of activity. A full-time file clerk to be responsible for the proper storage and subsequent production of engineering data is usually outside the budget available for the small office. Consequently, a filing system suitable for such use must be simple and all inclusive. Flexibility to accommodate a wide variety of activity is also a requisite, for rarely are there two offices whose work is confined to identical fields.

Classification is the basis of filing. Once a satisfactory method of classification is adopted, a satisfactory filing system follows easily. The method described below has been successfully applied to the files of an engineering department for a city of about 150,000 population and is equally suited to smaller and larger offices.

Primary classification of subject matter is according to location. City work is referenced to the street in which the work is located, limited by cross streets, thus: Main Street—Howard Avenue to State Street. Items which refer to areas larger than can be located by a single street are referenced to ward numbers. Work in other cities and locations is referenced by city and state name. Each item in the files is referred to by a corresponding index card. Standard 3x5 unruled cards of light material are used. On the bottom of each card, the locality reference is either lettered or typed. Cards with similar locality references are placed together in a card file cabinet and are separated with tab cards also typed with the location references.

The next classification of items is according to kind of work. A combination of three numerals or letters is used as an index number, the first numeral or letter of which serves as a code reference to the kind of work, the middle one to the particular nature of the item to be filed, and the third to the use for which the item was prepared. A typical classification follows:

First Numeral or Letter

0 Lines and grades
1 Pavement, curbs and sidewalks
2 Buildings
3 Water distribution system
4 Water supply and treatment
5 Sewers
6 Sewage treatment
7 Drains
8 Bridges
9 Railroads
a Street openings
b Stream improvement
c Parks

Middle Numeral or Letter

0 Correspondence
1 Survey notes
2 Drawings and maps
3 Computations
4 Reports on proposed work
5 Reports on completed work
6 Inspection and test records
7 Photographs
8 Legal documents
9 Books
a News items
b Magazine articles
Etc.

Third Numeral

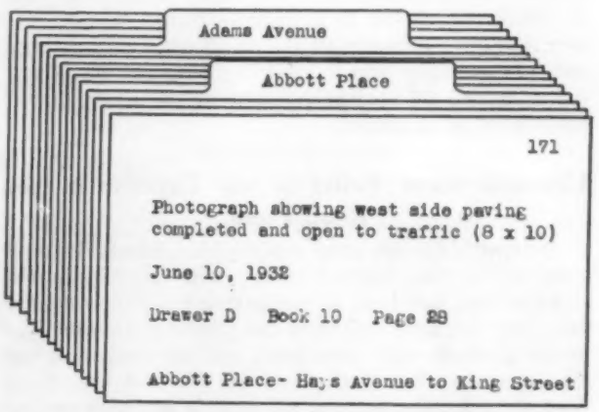
0 Plan of proposed work
1 Records
2 Cost estimates
3 Payment certificates
4 Contracts
5 Specifications
6 Bid prices
7 Catalogs
8 Operating records
9 Materials testing
a Tax map
Etc.

This classification may be extended indefinitely using upper and lower case letters and symbols if necessary to encompass a wide variety of work. Usually small offices require only a small number of divisions, not more than ten or fifteen. It is important that divisions be arranged in order of importance so that numerals rather than letters will be used in the files. There is no objection to the use of letters, other than that numerals are easier to arrange in order.

Thus, the entire reference number for each article filed consists of a number, of three digits, describing the particular item in code. The number is placed both on the article and on the index card in the upper right hand corner. Cards are arranged numerically for each location. As a result all references to each project are automatically grouped together. As an example, index number 311 refers to record survey notes for water distribution works; the next card may be number 333, referring to computations for certificates of payment on the same kind of work. Because work of the same kind in a single location is rarely duplicated, adjacent cards will generally refer to the same project.

In addition to the locality reference and index number, a brief desscription of the item and a reference to its location in the files is indicated on the card. The illustration shows a typical card arrangement.

This system of indexing possesses numerous advantages. Index numbers are brief. Each number describes the item in code. Location of filed items is easily



Typical arrangement of index cards

obtained. If a drawing is sought from the files, showing proposed sewer construction, reference to the file cabinet for cards under the street name and number 520, will immediately identify the drawing and furnish its location in the office.

Separate files should be used for standard-size articles such as letters, computations, field notes, drawings, etc. Drawings are cross referenced with accession numbers, consisting of a letter indicating the particular standard size of the drawing and a serial number indicating the order of acquisition of the drawing. Both the index and accession numbers appear on the drawings, which are filed according to size and accession number rather than by index number. Accession numbers for drawings appear also on the index cards in place of the notation indicating the location of the drawing in the office. A separate listing contains the titles, index numbers, size, material, title and description of the drawing, arranged in order of increasing accession numbers. This list serves as a guide for taking inventory of the valuable maps and drawings.

All computations and general notes are made on letter size paper, as are many of the drawings. This practice makes it possible to use standard letter files as filing cabinets. Sizes of larger drawings are selected so that blueprints will fold to letter size as further advantage of compactness. Under the system described all items of the same nature can be filed in the same location: letters in one file, computations in another, drawings in another, etc. The combination of cards and files is such that items may be taken from the files on consideration of either the general or the detail classification. Locality references used for the index cards are used in the files, so that all data pertaining to any project is in a single group. With such modifications as are necessary to suit peculiar local conditions, such a system will serve all the needs of the small office and is sufficiently elastic to permit its continued application through expansion of the small office into a large one. If ordinary care is used in filling out and filing index cards, all the information in the office should constantly be available.

Unemployment Relief at the Expense of the Road Fund.

Men with shovels have replaced machinery in road grading in St. Louis County, with benefit to the unemployed but loss to the taxpayers. The county last year let nine contracts for grading, in which no blade graders were permitted, and no tractor except for loosening the dirt, while all the dirt had to be loaded by hand-shovelers, all local labor, with preference given to married men. The contracts specified the minimum number of men that must be employed (about one for each 100 to 200 cu. yds. of grading) and wages of at least 35 cts. an hour, with a maximum week of 36 hours (probably based on four 9-hour days).

More than a thousand men were employed, earning $12.60 a week. But the bids ran $1.00 to $1.10 a yard, while the work could have been done by machinery for 17 cts. a yard. On one 30,000-yard contract on Woods Road, 180 shovelers loading thirty 1½-yard team-drawn dump wagons and sixteen motor trucks moved about 1400 cu. yd. of dirt in nine hours, which is about the average production of one good elevating grader.

The above figures (which are given by "The Earth Mover") indicate that the taxpayers of St. Louis county paid between $100,000 and $150,000 out of their road fund for unemployment relief and not for road work; that for the same money they could have secured five or six times as much grading. The relief was needed and necessary, but it was hard on the road fund, and in later contracts hand grading has not been required.

Connecting Sewer While in Service

In connection with highway improvements in Pensauken Township, New Jersey, the State Highway Department found it necessary to relay in a new location about 250 feet of 20-inch sewer which served to carry the effluent of the Merchantville sewage treatment plant to its outlet in Coopers creek. The line was running full and even under a noticeable pressure at times, but it was found possible to interrupt the flow for a maximum of 3½ hours while making the junctions between the old line and the two ends of the new. As it required 1½ hours to drain out the outfall sewer, this left 2 hours for the actual work.

As grading the road would reduce the cover considerably in some places and increase it in others, it was decided to use cast-iron pipe for the new section, and 20-inch de Lavaud centrifugal pipe in 12-foot lengths was used.

In order to prevent deposits and the other objectionable features which are known to result from failure to provide a continuous uniform sewage channel through a manhole, it was necessary to build a curved 20-inch channel connecting the ends of the old and new lines, and to do this as well as to make the break in the old line, all in two hours, and this was the difficult part of the job.

At each junction of the old line with the new, a manhole was built large enough to enclose both the old and the new line and a curved connection between the two about 4 feet long. The iron pipe was laid, the old main drained, and those sections of it inside the manholes were broken out. Meantime a canvas pipe about 20 inches in diameter and 8 feet long had been made of the heaviest canvas obtainable, triple stitching being used, the canvas being kept wet so as to be workable. When the break in the old line had been made, one end of the canvas tube was slipped over the inflow end of this and held in place by means of a leather belt pulled tight around it. The lower end was slipped inside the end of the iron pipe, into which it extended three or four feet.

When the effluent again flowed through the line, the pressure of it forced the canvas into contact with the inside of the iron pipe, making a perfectly tight junction and giving the desired shape of channel. Brick was then built around this tube making a masonry channel open at the top, and when the mortar had set the canvas was removed.

This plan was suggested by W. Sharpe, engineering inspector of the department. The work was under the supervision of J. A. Williams, division engineer of the highway department, with Elmer Parker as resident engineer.

Bituminous macadam road in May, 1912, soon after completion.

Same road after twenty-one years of service

Bituminous concrete surface after one year of service

Same road on its twentieth birthday

Connecticut Avenue Experimental Road, Chevy Chase, Maryland.

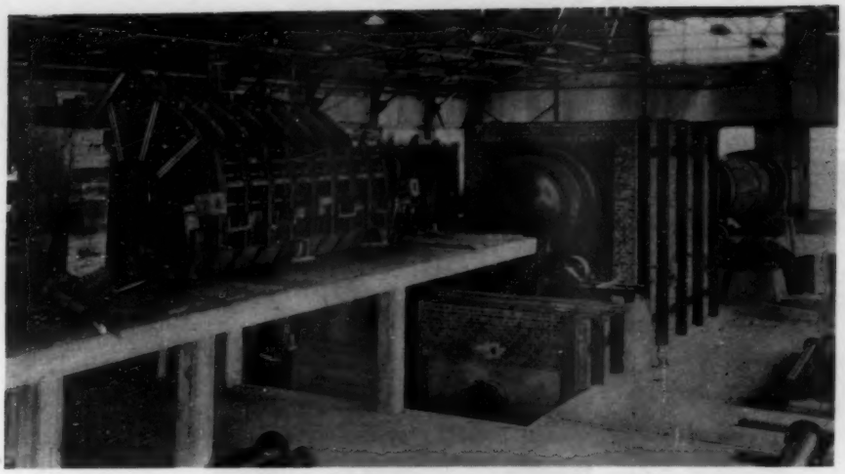
Connecticut Avenue Experimental Road Now Twenty Years Old

THE Connecticut Avenue experimental road, extending from Chevy Chase Circle to Chevy Chase Lake, in Montgomery County, Md., was built during the years 1911, 1912 and 1913 by the Bureau of Public Roads. The road was constructed as two separate projects, the dividing line being at Bradley Lane. South of that point sections were constructed of water-bound macadam with subsequent bituminous surface treatment and also sections of bituminous macadam. North of Bradley Lane the sections consisted of Portland cement concrete and of bituminous concrete and brick on Portland cement concrete foundation. All of these experimental sections are now either 19, 20, or 21 years old and all are in service under a heavy traffic.

Photographs showing two of these sections immediately after construction and after a lapse of twenty years have been published in "Public Roads," the official publication of the Bureau, and are presented herewith through the courtesy of the Bureau. Two of these show a portion of experiment No. 3, penetration bituminous macadam in which a fluxed native asphalt was used, constructed in 1911. The initial cost of this section was 64.69 cents per square yard. In 1918 a surface treatment costing 20.84 cents per square yard was applied. Maintenance costs prior to 1918 total 1.44 cents per square yard. Since 1918 a total of 9.62 cents per square yard has been spent for maintenance. The traffic has been increasing steadily since the road was built, and in 1931 reached an average density of over 4,000 vehicles per day.

The other two photographs show a portion of experiment No. 2, an asphaltic concrete proportioned in accordance with the District of Columbia specifications and laid 2 inches thick on a foundation of 1:3:7 gravel concrete. The experiment was divided into two sections in which limestone and trap-rock screenings, respectively, were used. Limestone dust was used as filler and the binder was a fluxed native asphalt.

The construction cost was 195.65 cents per square yard. The section has given very good service for 20 years under an increasing burden of traffic, which in 1931 reached an average daily density of more than 3,000 vehicles. Wear and depressions have developed near the gutter, and been repaired with cold-patch mixtures of tar and stone chips. Maintenance costs during the 20-year period totaled 20.38 cents per square yard.



Perkins Dryers at Houston treatment plant. Partially built Oliver filters at the left foreground

Mechanical Equipment in Sewage Treatment Works

By A. Prescott Folwell
Editor, PUBLIC WORKS

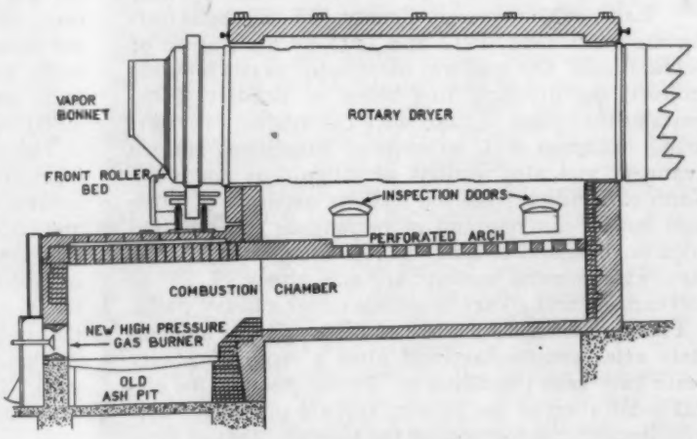
VIII—Disposing of Sludge (Continued)

Dryers

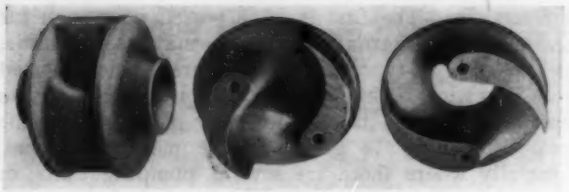
BY vacuum filters the moisture can be reduced to 80% or slightly more, but this is not low enough for commercial fertilizer or for burning. Further drying seems practicable only by use of heat. (Mixing with the vacuum-dewatered sludge two or three times its volume of dry combustible material such as slack coal, sawdust or paper has been suggested for facilitating incineration.) Dryers have been used in several plants, among them Milwaukee, Wis., Pasadena, Calif. (using a Ruggles-Coles dryer), and Houston, Tex. (a Perkins dryer). These use heat, which may be obtained from coal, oil, gas, or municipal rubbish, or from the burning of the dried sludge. The relative costs of these fuels (including interest and depreciation on equipment for burning them) will determine the choice.

The Ruggles-Coles dryer is a double shell semi-direct heat dryer, the hot gases first passing through the inner shell, the heat applied to this shell being taken up by the material constantly dropping on it, and then returning through the showering material in a direction counter to that in which the material moves as the outer shell revolves, leaving at a temperature of about 290° F., although entering at 1800° or more. According to the manufacturers, assuming a sewage flow of 7 m.g.d. and ratio of sludge to sewage of 25 to 1,000,000, then about 80 gals. of oil per m.g., 50 h.p. of power, and 50 cts. for maintenance, renewals, grease, etc., are estimated; while of labor, 2 men per shift are needed. The cost of dryer and auxiliaries would be about $4,000 per m.g.d. The assumed operation would normally reduce sludge of 83% moisture to one of 5% moisture. If the applied moisture can be reduced, the cost would be lessened. A 7 m.g.d. plant requires floor space about 20 by 90 feet; for 14 m.g.d. it would be necessary to consider an additional length of only 15 feet for building requirements.

The two Perkins dryers at Houston are gas-fired rotary kilns (similar to those used in cement mills) 60 ft. long, one 5 ft. and one 6 ft. diameter. About 18½ ft. at the upper end is enclosed by a furnace 25 ft. long and 10½ ft. wide. A single gas burner 18 in. diameter fires a combustion chamber, and the hot products of combustion pass vertically through a perforated arch into a heating chamber which surrounds the dryer (as the material is inflammable, direct firing is impracticable). Filter cake dried to 80% moisture is fed by conveyors into the end of the dryer and subjected to



Partial longitudinal section of Houston dryer.



Impeller of Fairbanks-Morse sewage pump.

Impeller (cut in two through the center) of Chicago Pump Co.

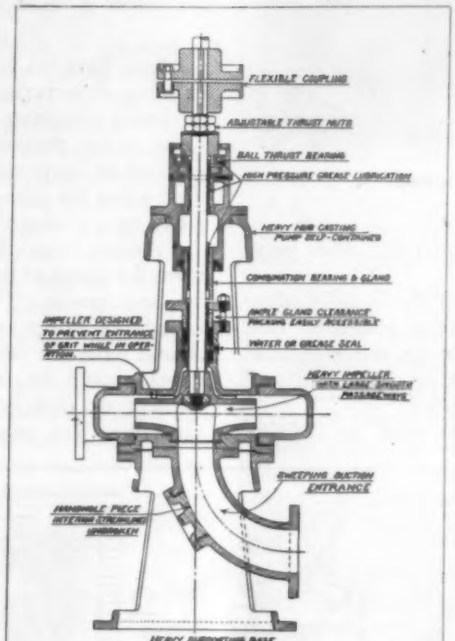
Propeller of Morris Screw pump.

a temperature of about 1600° F. for an hour; the kilns meantime being rotated by motor so that the material moves slowly toward the discharge end. About 18,000 cu. ft. of natural gas is used per ton of material treated. As the dried sludge travels by belt to a screen, any iron is removed by a magnet. After screening, it is ground and screened again and sold as fertilizers under the name of Hu-Actinite. The plant has a capacity of 15 tons of dry sludge a day.

A combined dryer and incinerator, a development of a vertical retort by the Isbell-Porter Co., has been tested for a year by that company in connection with upward filtration through slag filters. Each filter consists of a steel-tank 6 or 8 feet diameter containing 3 feet depth of 1½-inch commercial honeycomb slag through which raw sewage passes, leaving about 70% of its suspended solids in the interstices and as sediment on the top. When beginning to clog, the tank is removed and the slag dumped into a hopper at the top of the dryer. From the hopper it passes downward through a tubular "calciner," where hot gases diluted with air preheated to 800° F. pass horizontally through the mixture of slag and sludge, drying it at the upper part of the calciner and burning it at the lower. When the sludge is about 8% of the slag, the volatile matter in the sludge furnishes 35 to 40% of the fuel required, the rest being supplied by oil burners. The ashes are separated from the slag by running them over a bar screen with ½ in. openings; about 2% of the slag being disintegrated and lost each time. A million-gallon plant requires an area of about 75 by 200 feet.

A method of atomizing sewage sludge and drying it with hot air, and using the dried sludge as fuel, has been developed by Industrial Associates, Inc.

String Discharge Filter. Municipal Sanitary Service Corporation requests us to state that the vacuum filter to which the name "D N" was applied in our January issue has been named by them the "String Discharge Filter," by which name it will be known in the future.



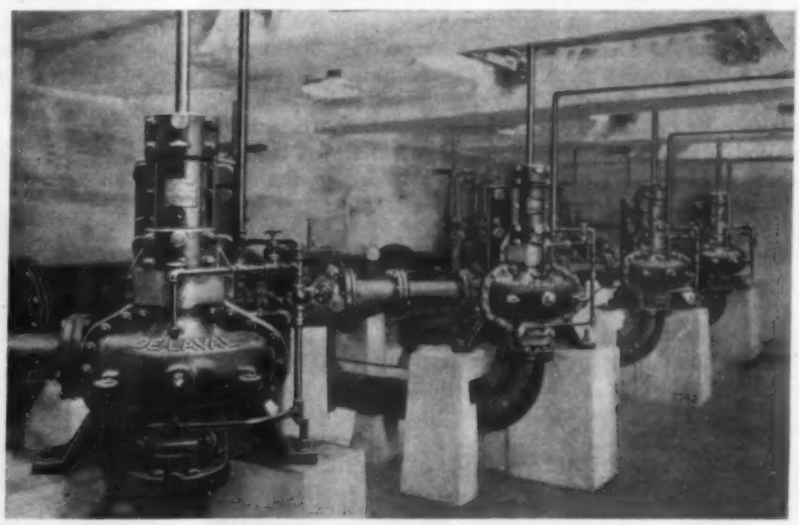
Section of vertical centrifugal Morris sewage pump.

Centrifuges

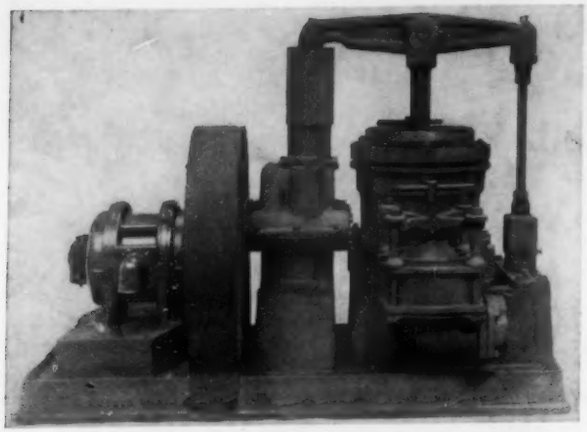
Separation of water and suspended solids by centrifugal force has been successful in a number of industries, but so far no centrifuge or method of operating them has been developed as a physical or financial success. Possibly recent or future developments in conditioning sludge may make centrifuging practicable.

IX—Sewage and Sludge Pumps

The majority of treatment plants require the lifting of sewage, sludge or effluent through a height seldom exceeding twenty or thirty feet. Other things being equal, pumping effluent is preferable to pumping sewage because the latter contains rags and other objects likely to clog the pump, and sometimes grit which causes rapid wear. But this means deeper



Four of the six centrifugal pumps at Traverse City, Mich. Pumps range from 1500 g.p.m. to 300 g.p.m.



"Domestic" walking-beam pump.

excavation for the plant, which generally adds very considerably to the cost.

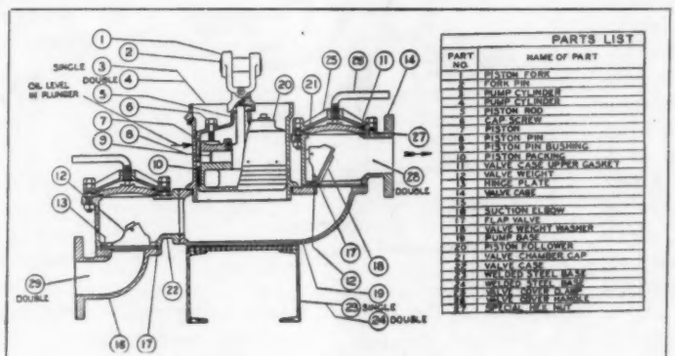
Most recent plants are so built that the liquid sludge is forced out of hoppers by hydrostatic pressure. But in some cases pumping is preferable for removing the sludge; and seems necessary for mixing the contents of digestion tanks, where this is practiced.

Other small pumps are sometimes used, as for circulating hot water through the heating pipes in digestion tanks, emptying tanks for cleaning or repairs, etc.

In small plants, sludge used to be, and in some still is, removed by hand pumps such as tin "boat pumps" or small portable diaphragm pumps. Portable diaphragm, plunger, or centrifugal pumps are provided in some plants for occasional services such as dewatering tanks or basins for repairs or cleaning.

The pumps in common use may be classified as reciprocating (either plunger or diaphragm), centrifugal, pneumatic, or air lift. The last two should not, perhaps, strictly be called pumps. The pneumatics are usually called "ejectors"; and this name is applied also to some small centrifugal pumps. Whatever the type, the most important characteristic is freedom from clogging by rags, sticks or other objects more or less common in sewage, and accessibility for removing such obstructions if they occur. Next in importance is reliability of operation; interruption of service for even a few minutes, especially when pumping sewage into or effluent from a plant, may cause serious backing up of the sewer or flooding of the plant. Next, probably, is resistance to wear and erosion or other deterioration of the pump parts which will necessitate repairs or replacement. Efficiency is important; but as the lift is generally small and the power required is consequently low, it is of much less relative importance than in the case of water works pumps.

The power used may be steam, internal combustion or electricity. The first is seldom used now, even for large plants. Internal combustion may use gasoline, fuel oil (Diesel type), or gas. Where gas is collected from digestion tanks, this (if there is a surplus from heating the tanks) is used in many plants for engine fuel. Electricity is generally the most convenient, especially where there are several pumping units, or where the pumping is intermittent. Relative accessibility of power cables and of routes for bringing fuel may affect the choice. For pneumatic or air-lift plants, the power is necessary for driving the compressors.



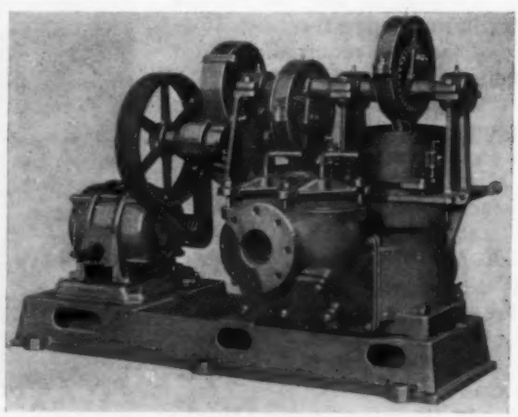
Longitudinal section of "Rex" plunger pump, with names of parts.

Centrifugal Pumps

These have no valves to be interfered with by rags or other objects; even foot valves on the suction are generally eliminated by placing the pump low enough to be under pressure. They may be run by either a vertical or horizontal shaft. The former is commonly used when the pump is in a deep well, which should be a dry well so that the pump is accessible.

Freedom from clogging and economy depend largely upon the shape of the impeller and its casing. As stated by one maker: "Centrifugal pumps for handling liquids carrying solids which tend to cause clogging should have the interior easily accessible, and the passages should be large, open and direct, offering no corners or obstructions to cause clogging. Narrow clearances are unavoidable at the working joints, as between impeller and casing and around the shaft at the stuffing boxes, but such parts should be so designed as to eliminate the entrainment of solids." Several companies make the casing with a horizontal flange joint between the two parts, so that the top half can be lifted off to get at the interior with a minimum of trouble; while quicker access for removing obstructions is provided by a handhole in the suction just outside the casing. Three designs of impellers are shown in the illustrations. One of these is a so-called "screw" or mixed flow pump, especially

(Continued on page 28)



Barnes sludge pump, eccentric type.

THE EDITOR'S PAGE

Recovery Through Public and Semi-Public Improvements

One of the events of the past month of greatest importance to those whose interests are chiefly connected with public and semi-public works was the meeting in Detroit of twenty-one national organizations of engineers, contractors, equipment manufacturers and others directly concerned with such works. Each of these held its regular annual convention, but they also took joint action, appointing a committee to plan a method of organizing a union of construction industries, and adopting twenty-three resolutions urging actions which, in their opinion, would aid greatly toward business recovery by stimulating a revival of one of the nation's largest industries.

Among the actions urged were an immediate construction program for highways, waterways, flood control, housing, sanitation, water works, sewerage, refuse disposal and other needed public and semi-public improvements, accompanied by long-term financial planning therefor; liberalization of self-liquidating requirements and reduction of interest rates by the Emergency Relief agencies; continuation of federal aid for state highways, including such portions as lie within city limits; use of motor-vehicle fuel taxes and license fees exclusively for highway construction and maintenance; and the performance of such work "by the most modern and efficient methods, and we oppose the indiscriminate substitution of hand labor therefor."

Most of the other resolutions referred to financing, demanding economy in administration; paying for public works by bond issues or issue of increased currency rather than by taxes; opposing the dole; reduction of interest rates; amendment of bankruptcy laws; advocating the sales tax, and other federal, state and municipal procedures.

The tax burden is already heavy, and a large part of it is due to interest and sinking fund charges on money borrowed in the past for public works; and further borrowing will increase future taxes, and is strongly condemned by some financiers. But unemployment has reduced greatly the amount of the present taxes which it is possible to collect, and if continued for another year may compel cities and states to borrow, in lieu of taxes, a large part of the funds necessary for the operation of the essential public functions. Borrowing would therefore seem to be necessary; and better borrow at once, to distribute the money in exchange for services rendered, the receivers to pay it back gradually in the form of increased future taxes, than to have citizens continue idle and unable to pay taxes, supported by the dole provided by increased taxes from those who can pay, with borrowing only postponed as the sole alternative.

Fortunately money can be had at very low interest where the security is good. If labor also would offer its services at reduced wages—if only 25 to 30 per cent less, corresponding to the reduction in living costs and in interest rates—the total amount now paid in wages would suffice to practically wipe out unemployment; and with public works begun on a large scale by borrowing money, taxes as well as living expenses could soon be paid by all and normal conditions be restored.

It is reported that President-elect Roosevelt plans "a widespread public works program, possibly entailing five billion dollars at the start" and "intense stimulation to semi-public works projects . . . through the R.F.C." It is our opinion that no more promising move could be made provided it is not offset by unwise methods of raising the funds for paying for these works.

What Engineers Can Do

Engineers as a class have little experience in financial matters and are loath to offer advice as to how to get the country out of this slough of despond. But they and many others believe that immediate inauguration of a country-wide program of public works construction would go far toward starting things upward. A few weeks or months may see a vigorous move along this line. Then what? If the mayor asks the city engineer, or the governor asks the state engineer, "what needed public work can we start at once?" has the engineer an answer ready?

Once it decides to start working, the public will be impatient of delay for preparing plans, and rightly so. The plans should be ready. And plans prepared under the urgency of such impatience are not likely to be the wisest possible.

In justice to his public, and to warrant its approval of his ability and foresight, he should have plans ready for such needed improvements as seem likely to be chosen for construction. First he should study local conditions (including popular prejudices) to endeavor to foresee what among the many needed works are likely to receive the approval of the citizens and their representatives. He himself should be at least as good a judge of this as they are, and should have his reasons and conclusions all thought out ready for presentation at the right time.

The selected projects should then be planned as thoroughly as though already ordered by the governing body, and cost figures so prepared that they can readily be adjusted to varying rates of wages or to other basic factors subject to change. He should so prepare himself that he can when called upon state that he has foreseen this emergency and can, in one or a few days, complete the desired plans ready for immediate letting of contracts or other use.

This may mean unpaid work outside of busy office hours for him and his assistants, but they would not be the only public-spirited citizens who are giving of their time and ability to aid in bringing the country out of its predicament. Aside from the credit he may receive therefor, he should consider it a duty he owes to his city, state and nation.

Practical Details of Concrete Construction

By William E. Barker
Highway Engineer, Portland Cement Association

VIII—The Construction of Joints in Concrete Pavements (Continued)

Transverse Joints

Transverse joints are expansion, contraction or construction joints. An expansion joint is a space left between the ends of slabs to permit free expansion of the concrete. It is commonly filled with some plastic or compressible material to exclude water and dirt and protect the edges of the slab. Contraction joints are put in to divide the pavement into slabs of such length that the tensile stresses set up by contraction will not cause transverse cracking. They are commonly the dummy type already described. Construction joints are butt joints put in wherever work stops, to form a square end for the slab.

Expansion joints may be premolded, poured, or one of the newer metal types. Premolded joints are built by placing a molded strip of bituminous material or rubber on edge on the subgrade in advance of concreting and casting concrete about it. Such material is too flexible to stand alone, so it is held upright by a bulkhead or by a metal cap, withdrawn after the concrete is in place.

Poured expansion joints are made by casting concrete about a bulkhead that is withdrawn after the concrete has partly hardened. The space thus formed is later filled with hot bitumen or waterproofed sawdust.

Construction joints are built by casting concrete against one side of a bulkhead. Work is resumed after the concrete has hardened, the bulkhead is removed and new concrete is placed against the face of the old.

In building transverse expansion and construction joints it is essential that the plane of the joint be perpendicular to the subgrade. If it is not, the joint becomes a wedge and expansion pressure will lift one slab end above the other, producing a bump and causing impact and subsequent breakage. Bulkheads should be solidly staked in the correct position and so removed that the expansion material is not pushed askew by pressure of the concrete. Bulkheads removed from fresh concrete should be lifted slowly from one end while workmen shovel concrete into the space vacated, to support the joint material. Because they leave less space when removed, metal bulkheads, cut to the cross-section of the pavement, are best.

No concrete or other hard material should be left in the joint anywhere. If there is concrete in the bottom, expansion will cause an underspall that will lift the slab-ends and cause damage. If there is concrete at the ends of the joint, expansion will result in crowfoot or longitudinal cracks running from the obstruction.

If concrete spans the joint at interior points, a surface spall and longitudinal cracks will result. If even a little concrete is left above expansion material, ugly surface spalling is certain.

Dowel bars are put across transverse joints to make slab-ends work together in carrying load. They are commonly ¾-inch plain round bars 2½ to 4 feet long, spaced 18 to 36 inches apart and projecting equally into each slab. If the joint is to open and close, the dowel must not be bonded in both slabs and there must be a space beyond the unbonded end into which the dowel can push as the joint closes. Bond in one slab may be broken by encasing that half of the dowel in a metal tube. This tube should fit so snugly that it can just be forced on by hand, for a loose tube destroys most of the dowel's value. The dowel is kept from going to the end of the tube by a plug of felt, a slight dent in the tube, a wire threaded through holes on opposite sides of the tube or some similar device, to provide end clearance. Or bond may be broken by painting the dowel with red or blue lead followed by a coating of heavy oil. In that case, space at the end of the bar is provided by a short metal tube or by placing a cork, potato or any similar harmless compressible material on the end of the bar. The space left should have a depth at least as great as the width of the joint.

Joint failure caused by joint faces which are not perpendicular to the subgrade. Dowels did not prevent faulting of this joint.

Dowels must also be accurately parallel to the center line and surface of the slab, for if they are not they will obstruct the free opening or closing of the joint, causing longitudinal or transverse cracks or lifting of the slab-ends, with subsequent breakage. Dowels should be supported in the correct position by chairs strong enough to hold them in place against any pressure developed during construction.

Dowels will not prevent the faulting of joints not built perpendicular to the subgrade.

Permanency of Mud-jack Pavement Raising

A. C. Benkelman, research engineer, Michigan Highway Department, reported to the Highway Research Board last December, giving conclusions from investigations made during the previous year on the shrinkage of materials used in raising pavement slabs by the mud-jacking method. A brief abstract of the report follows.

Success in raising pavement slabs permanently by the mud-jack process depends to a large degree upon the characteristics of the materials used. The effects which texture, amount of organic material present, amount of cement used and amount of water needed for workability have upon the shrinkage properties of the soil appear to be the significant factors. Two hundred and fifty samples of soils used with mud-jacks of both the piston and compressed air type were analyzed and the range in satisfactory grading for each type determined. In general, coarser soil can be used with the compressed air jack than with the piston jack. From a series of laboratory tests the effects of texture, organic content, water content and cement content upon shrinkage, workability and stability were studied, resulting in diagrams showing the relation between amount of cement, organic content and shrinkage. It appears to be desirable to use as coarse a soil containing as little organic material as possible. Unless the amount of organic material is limited, the use of the customary small amount of cement (5 per cent) will have little effect in reducing shrinkage, since high organic content requires an excessive amount of water for workability.

Important Details in Treated Timber Bridge Construction

THERE is one basic principle of treated timber bridge construction which engineers should keep in mind—that "design and construction methods should be followed which will necessitate a minimum of disturbance to the treated exterior of the materials used," says W. A. Stacey, field engineer, Service Bureau, American Wood Preservers' Association, in *Wood Preserving News*. "The unavoidable cutting into any preserved unit of such construction should be followed by an adequate field treatment that will render this portion of the unit as durable as the remainder of it, or as nearly so as possible. The principle involved is extremely simple; the cost of field protection to unavoidable field cuts is negligible, and common sense on the part of the engineer in charge will dictate field methods that will be entirely adequate.

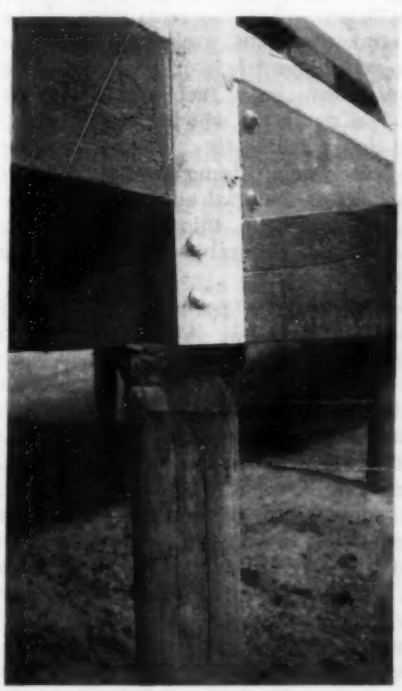
"It is noticeable that highway engineers generally protect pile cut-offs under bridge caps very carefully with several coats of hot creosote and pitch followed by a protective roofing of galvanized iron or other material. Nevertheless, in some instances the wing piles at the abutments are left without sufficient protection after having been cut off to fit the top level of the bulkhead plank. By all means should these be taken care of, as the wing piles are more exposed than the other piles under the bridge. The pile top covering of pitch-saturated burlap used by the Nebraska State Highway Department is particularly effective in that it covers the sides of the pile also for nearly a foot, being wired down in that manner.

"The use of a straight planked abutment is sometimes more desirable than one from which the wings are carried out at an angle of 45 or 90 degrees. While in the design of the former type there is no need of cutting the bulkhead material after treatment, the proper use of cleats will also obviate the necessity for framing the plank used in the angle type.

"It is not advisable to allow a bridge contractor or foreman to fasten sway braces to piles with one standard length of bolt. If so, you may find him trimming off the sides of the larger piles with an axe and putting untreated blocks of wood under the bolt heads on the smaller ones. Standard designs of the Wyoming Highway Department require the contractor to provide bolts with sufficient threads so that extra washers are not required for a tight fit on the bolts. In no case should creosoted piling be adzed or grained to secure an even bearing for the sway bracing. If necessary, treated blocks should be used between the bracing and the pile to form a level bearing.

"Preframing and boring of timbers as completely as practicable at the treating plant before treatment is common practice and is recommended. Particularly desirable for a smooth floor is the requirement that all stringer ends be surfaced on one edge for a length of 18 in. to an even depth before treatment.

"In some cases caps are secured to the piles by means of a U-shaped strap iron over the tops of the caps, and the ends of such an iron fastened by bolts or lag screws into the pile. The drift bolt method of fastening caps to



Standard Pile Cut-off Protection in Use in Nebraska. After Applying Several Coats of Hot Creosote and Pitch a Covering of Pitch-Saturated Burlap Is Wired

Railroad Bridge Bent Showing Treated Blocking to Secure Even Bearing for Sway Brace. All Trimming of Treated Piles Prohibited

Courtesy "Wood Preserving News."
Pile Cut-Offs Which Have Been Coated with Hot Creosote and Roofed with Heavy Tar Paper and Tar

piles is the most common one.

"The following notes are taken from a recent system standard of the Atchison, Topeka and Santa Fe Railway and should be of interest in that they summarize that company's years of experience with treated timber as applied to bridges designed for heavier loadings than are modern highway bridges":

All timber and piles will have a preservative treatment.

All timber will be cut to exact length and surfaced where required, at the treating plant before treatment is applied.

Caps, stringers and guard rails will be pre-bored before treatment, as per details.

Treated timber and piles should be handled with extreme care, and so far as is possible avoid damaging the surface by unnecessary use of timber hooks, peavies, etc. When possible, timber should be handled by rope slings, and the dropping or throwing of timber and piles from an excessive height should be discouraged.

When necessary to disturb the surface of the treated timber and piling or when the surface has been damaged through handling, such surfaces should be mopped with a liberal quantity of hot preservative followed by two applications of hot sealing compound.

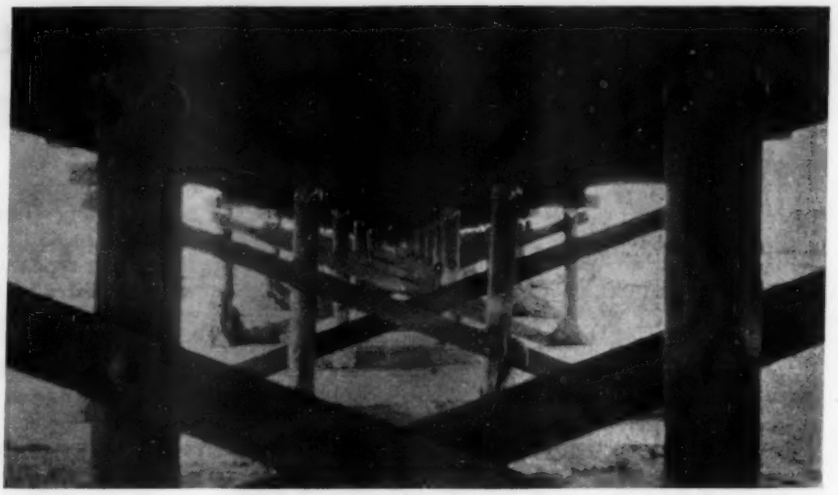
When necessary to bore into treated timber, the hole must be swabbed thoroughly with hot preservative and swabbed again with hot sealing compound and the bolt at once driven home. Pre-bored holes not used, and unused holes bored in the field, shall be fitted with round creosoted plugs. These plugs to be dipped in hot sealing compound before being driven.

When treating the top end of piles, a liberal quantity of sealing compound shall be poured on before the sheet metal cover is placed. Before placing the cap, the sheet metal cover shall be bent down on the sides and a liberal quantity of lukewarm sealing compound poured on the sheet, and spread over area covered by cap.

When it becomes necessary to work from scaffolding in constructing the bridge, such scaffolding should be hung from ropes, and not nailed to the timber or piles.

Metal sheets protecting caps, stringers, and piles, are covered by details on standard plan.

All nuts, heads of bolts and tops of washers shall be painted with two coats of approved bridge paint just before completion of the work. Stringer and cap anchors shall be given two coats of approved bridge paint before being placed in position, and shall receive a third coat just before completion of the work.



Under View of Very Well Built Creosoted Bridge Showing Pile Cut-Off Roofing. Right Foreground Pile Has Been Cut to Permit Use of a Short Bolt.

Soundings for Bridge Foundations

Reliable soundings of bridge pier and abutment sites is a most important preliminary to bridge design. This fact was emphasized by Frederic Greve, assistant bridge engineer, Tennessee Highway Department, in a paper before the school for resident engineers. He cited a number of instances when insufficient sounding data necessitated changing plans after construction had begun, always resulting in increased cost to the state. Unexpected rock or hardpan made it necessary to change from pile foundations to concrete; or a fault in the rock in a river bed just where a pier was to come added greatly to the expense, which could have been avoided by changing the pier location and span lengths had it been known in time, but when discovered the steel was already on the job.

The procedure of the Bridge Division in obtaining the desired information is described by Mr. Greve as follows:

On the larger bridges, in order to get as full and complete data as possible, we prepare sounding sheets showing the points at which we deem soundings necessary. These sheets are sent to various drilling companies and the work let on a competitive bid basis. For the main river piers we call for three soundings on the center line of the pier, these holes being cored thirty feet into the rock. In addition, we call for soundings to rock around the base of the pier at about six-foot intervals. For the bank piers, three holes on the center line of the pier and coring six feet into rock is deemed sufficient. For the remainder of the approach, where concrete bents are used, one hole under each footing right and left of the center line of roadway going down forty feet unless rock is encountered at a less depth, in which case a note to stop at rock is all that is called for. But the drilling company must log each hole, giving the amount and character of each kind of material encountered.

Naturally, for small bridges, this might seem expensive, but the expense generally is saved in the design.

A type of drill used with very good success in the Third Division is a churn drill. This is a one-inch round rod sharpened at the point. Two men with Stillson wrenches keep turning the drill while another man drives it with a sledge hammer. A rod one inch in diameter is used. While it is my understanding that this rod is used for soundings up to twenty feet, I believe its use should be limited to depths of ten feet or less. A sunken log, boulder or some other obstruction can stop the driving and the information thus obtained is frequently misleading. The rod may strike a stratum of gravel and fail to reach a soft stratum underneath it because the resistance is so great that it cannot be driven further.

For shallow foundations, a simple method for examining the foundation site is to sink test pits by open excavation. The advantage of this method is that the variation in the character of the material passed through can be examined in its natural compact state.

Organization for Snow Removal in Michigan

By B. C. Tiney
Maintenance Engr., Michigan State Highway Dept.

IN 32 of the 83 counties of Michigan, the State highways are maintained by State organizations, while in the remaining 51 counties it is accomplished by annual cost contracts with county road commissions. All maintenance work is budgeted, by maintenance sections and classes of work, for a calendar year in advance. Equipment used in contract counties is furnished by the county road commissions on a daily rental basis, the rental rate covering repairs and depreciation. The work is in direct charge of a maintenance superintendent in each county. The supervising organization of the State Highway Department consists of 10 resident maintenance engineers who report, both directly and through 5 division engineers, to the maintenance engineer. This gives each resident maintenance engineer an approximate average of 8 maintenance superintendents and 800 miles of road.

A nucleus of our summer organization is carried through the winter for snow removal. These men consist of foremen, the best truck drivers and other key men. When the snow equipment is not in operation, they are kept busy at such work as painting signs, raising snow fence, repairing equipment and cutting dead trees within the right-of-way. It has been our aim to retain, as permanently as possible, those men who have been efficient and interested in their work. A heavy snow storm is often a severe test of the morale of an organization, and it is then that the real value of carefully selected men becomes most apparent.

A centrally located and heated garage, with complete repair shop facilities, in each county is a prime factor in good snow removal work. A mechanic is maintained at each headquarters for servicing equipment. A truck or tractor unit out of commission on the road in a storm is a serious matter, and too much attention cannot be given to keeping equipment in first class condition, and to having the means available for emergency repairs. From a repair and control standpoint, it is desirable for each superintendent to have his equipment centrally headquartered, but we have found it necessary in some counties to station some units in small garages at outlying points.

Procedure

In heavy storms, or on night work, two men are sent out with each unit for relief driving and to assist in case of trouble with the equipment. These men are instructed to give help to any motorist whose car may be broken down or off the roadway. Plowing is carried on continuously until the roads are cleared, using two shifts of men if necessary. The exception to this might be the case of continued high winds when no effective plowing can be done, and when visibility is so poor that the operation of equipment is hazardous. The only object in going out at such times would be to relieve motorists in distress, and our superintendents have sometimes sent equipment upon telephone requests.

In the southern part of the State, where traffic is heavy and thawing is prevalent, plowing is started when about 2 inches of snow has fallen. If this is not removed it is usually converted, within a day or two, into an icy surface, with resulting danger to traffic and expense of sanding. The northern part of the State, with less thawing, permits the maintenance of a snow mat on the road surface.

It is no longer sufficient that roads merely be kept in such condition that traffic can get through; they must be cleared wide enough for two-way traffic, and the surface kept smooth and free from snow or ice ruts. Proper maintenance of snow-mat surfaces will permit safe driving at practically summer speed, and this type of work will encourage winter travel. The work of widening should proceed as soon as possible after the road surface has been cleared for traffic. Banks which are allowed to stand soon become much harder to move, and a second storm following closely on the first may cause drifting in the roadway.

The matter of safety to other traffic in the operation of snow equipment is important. The following is quoted from the code of safety instructions to our field maintenance organization:—

> When driving snow removal equipment, extra precaution must be taken, when passing or being overtaken by other traffic, to avoid throwing frozen chunks of snow through windshields, or dangerously obscuring vision of other drivers. Speed of snow plows must be reduced even to the point of stopping, if such is necessary for safety of other traffic. A sudden swerving of snow plow equipment when striking hard, frozen masses of snow, has been the frequent cause of collision with other vehicles, and equipment operators must exercise increased vigilance under such conditions.

The portion of snow plow equipment visible from the front is painted yellow, and red flags are carried.

The above was presented at the annual road school of the Wisconsin State Highway Department.

Snow Removal Methods and Costs in Minnesota

Snow removal work on the State trunk highways in Minnesota is carried on by the regular maintenance organization, under which a sectionman and helper, supplied with a truck, have charge of approximately 25 miles of highway. The truck is equipped with a snow plow on the front and a wing on the left side; all plows and trucks being so arranged that they are interchangeable and that the trucks from adjoining sections can be coupled into a tandem formation in case of very heavy snow.

For purposes of control the State is divided into sixteen maintenance districts, with an engineer superintendent in charge of each district. Nine rotary snow plows, mounted on trucks, are held in reserve, as well as about twenty large plows and rotaries mounted on tractors. The reserve equipment ordinarily is used only for cleaning up operations. Nor-

mally this work is handled by the rotaries mounted on trucks; the tractor equipment being called upon only in case of necessity.

The time to start plowing is determined by the superintendents, although the exact time is left somewhat to the judgment of the individual sectionman, depending upon the nature of the storm, local conditions, and nature of traffic. In a general way, the plowing operations begin much earlier in the metropolitan and close-in areas on heavy-traffic highways, than on those where the traffic is lighter. The most economical operation is accomplished by beginning later, but the traffic needs oftentimes require starting almost as soon as the snow storm starts, even though operations during the height of a bad storm are inefficient, dangerous and apt to aggravate the seriousness of the situation.

Approximately ninety percent of our snow removal work is performed by "V" type plows and left side wings, propelled by trucks. However, one-way plows are beginning to replace the "V" plows, principally in the dense traffic areas and when the storm is not of too high a velocity; the velocity of wind, rather than the amount of snow, being the determining factor. The higher the speed which can be maintained, the more efficient is the plowing operation. Rotaries are very effective in widening and cleaning up operations.

There is not much argument but that snow removal pays on an important system of highways by keeping the traffic moving, resulting in uninterrupted trade and delivery of dairy and food supplies. From the highway funds standpoint we find that the uninterrupted tax on gasoline consumption more than pays for the actual work. However, regardless of whether it pays or not, the public attitude is such that we could not discontinue our policy of open roads throughout the winter on the State trunk highway system. This attitude is also growing very rapidly on the county systems, but is not so pronounced on the town roads controlled by the township organizations.

The cost of snow removal on the State trunk highway system, consisting of 6,891 miles, averaged $77.54 per mile in 1929, $53.88 per mile in 1930, and $28.94 per mile in 1931. It is interesting to note that the cost has been coming down in spite of the fact that the past winter was much more severe than the preceding two winters.

Icy roads are ordinarily taken care of by the use of sand or cinders (in many cases mixed with calcium chloride). Some of the spreading is done by machine, but the greater portion is unloaded from trucks by hand or spread by hand from stockpiles placed at critical points.

Operating Municipal Trucks

Pooling of truck equipment used in the public utility field, rather than departmentalized operation, is advocated in a report on a nation-wide survey of truck operation by electric, gas and water utilities, made by the General Motors Truck Company, Pontiac, Mich. The survey is one of a series conducted by this company and designed to find the most economical means of truck operation. To a large extent the same conditions are found in the use of municipally owned trucks, and the conclusions reached may be similarly applicable.

By operating trucks through a centralized department, the report states, less reserve equipment is needed, duplication is eliminated, trucks are more easily routed from one department to another, low-mileage trucks can be shifted to high mileage divisions and vice versa, thus making for uniform obsolescence, and idle time and overhead are reduced to a minimum. "The answer to the problem of economical dispatch," says the survey report, "is found in trucks under a separate transportation division. More and more firms are using this plan and finding that it is the most economical way of operating."

Finding that considerable losses are met through trucks laid up in the shop, the survey recommends a system of preventive maintenance, requiring drivers to report daily whatever service may be needed and having that taken care of during the night. More careful routing and systematic arrangement of loading facilties also are recommended.

Taking up the problem of truck replacement, the survey finds that "the real test of whether or not a truck should be replaced lies in the dollars and cents account of the work accomplished by the equipment and the cost of getting that work done." In other words, equipment should be replaced when the work it does could be done at less total cost by a new one.

Frank W. Skinner

Frank W. Skinner, who for about two years was associate editor of PUBLIC WORKS, died on December 24th, following an illness of several months. From 1887 until his death he devoted most of his time to writing and editing articles on engineering subjects and delivering lectures before college classes, engineering societies and other audiences. He therefore became widely known among engineers and made many friends.

He was born in Brownsville, N. Y., in 1858. After graduating from the civil engineering course of Cornell University in 1879 he was employed by the Pittsburg Bridge Co., the Delaware Bridge Co., and the New Jersey Steel & Iron Co. successively. In 1884 he was employed by the Dominion Bridge Co. as principal assistant engineer and later as resident engineer for that company on the construction of the St. Johns Bridge. During the next two or three years he was bridge engineer for the St. Paul & Northern Pacific R. R. and assistant engineer on construction of the Washington arch bridge in New York.

Most of his writing and lecturing was on bridge and other structural engineering; the last year or two of his life being given largely to writing descriptions of and lecturing on the George Washington bridge. "Arch Bridges" and "Specifications and Standards" were two of several books which he wrote. His regular writing for technical papers began with a series of articles on structural engineering and foundation work for the "Sanitary Engineer"; following which he became associate editor of that paper and its successor, "Engineering Record" (later combined with "Engineering News as "Engineering News-Record"). In 1915 he, with other associates, founded the publication "Contracting," which in 1920 was purchased by PUBLIC WORKS and Mr. Skinner was made associate editor of the latter, which position he held for about two and a half years, when he retired from editorial work and devoted the last ten years of his life to writing and lecturing.

Recent Progress in Producing Sparkling, Tasteless Water of Low Mineral Content

From Report to Am. Soc. of Municipal Engineers of Its Water Works Committee, L. R. Howson, Chairman

TYPHOID deaths in the United States have decreased over 85% since 1900, but a large percentage of the remaining 15% might easily be prevented, since they are due as much to laxity in handling water from its source to the consumer as to the use of water from polluted sources. With present-day knowledge of the factors causing typhoid and of the purification facilities available, particularly the developments in the application of chlorine, there is small justification for a typhoid death rate of even approximately 5 per 100,000.

There is now no excuse for any city, except under very unusual circumstances, to furnish a water having a very disagreeable taste.

Usually the savings in soap alone justify the softening of a hard water supply, and the many incidental benefits are usually fully as important.

We aim toward the day when all public water supplies shall be safe, physically attractive, pleasing to the taste and of low mineral content all of the time.

Appearance

All recent filter plants have been of the mechanical type. In general, recent trends have been toward longer mixing and settling periods, higher filtration rates, larger filter units in large plants, the use of coarser sand, and the inclusion of facilities for taste and odor control.

Improved appearance has not been confined to surface water supplies. In recent years many plants have solved the iron and manganese problem incidental to water softening. The removal of CO_2 in the softening process precipitates the iron and manganese and after filtration produces the blue, sparkling water typical of the lime-soda softening process.

Removal or Prevention of Taste and Odor

The most commonly used method of taste removal is through the use of activated carbon. At the present time over 400 water plants are using activated carbon. Of this number about 70% use it only at times when tastes appear; the remaining 30% use it continuously. The usual requirement is from 10 pounds to 30 pounds per million gallons of water, although there are a few cases where for a short time as high as 200 pounds per million gallons have been required for satisfactory treatment. Activated carbon is usually fed into the filter influent, although occasionally where series settling is available it has been added earlier in the purification process. While the cost of activated carbon varies with the requirements, a figure of $1 per million gallons is probably a general average. Among the larger plants using activated carbon are Minneapolis, Baltimore, East St. Louis, Toledo and Saginaw.

Second in importance to activated carbon in control of tastes in water is the ammonia-chlorine treatment. This is a taste-prevention measure, whereas activated carbon is a taste remover. The ammonia-chlorine treatment is most efficient in preventing the formation of chlorophenols, which produce a disagreeable taste. This process is extensively used on the Great Lakes supplies having filters and long detention basin capacity. Cleveland, Racine and Springfield, Ill., are among those using ammonia-chlorine treatment with success. Chicago, where there is no filtration, has recently experienced very objectionable tastes, attributed to phenols carried to the lake intakes from the Northern Indiana industrial plants. It is stated that the water department is planning to install facilities for ammonia-chlorine treatment at the intake cribs, utilizing the tunnels as reaction chambers.

The use of aeration for taste and odor removal is decreasing with the development of the more positive and more complete chemical methods of removal. For most conditions, aeration has at best been able only to *reduce* the intensity of odors. Spalding at Bloomington finds spray aerators remove about 20% of the odors in that water. In more recent designs of plants treating water in which tastes may occur, engineers are quite generally including facilities for one of the taste and odor prevention or removal methods.

The public has become "taste conscious." It will not without protest, and should not be required to, tolerate disagreeable tastes. Plants which have formerly experienced disagreeable tastes and odors but which have more recently controlled them now find that the public is much more sensitive to their presence than before treatment was resorted to.

Water Softening

There are now over 175 municipal softening plants in operation in the United States, of which approximately one-third treat well waters. Most of the municipal softening plants use lime or the lime-soda ash process, although the use of zeolite for waters high in sulphate hardness is increasing.

The cost of lime-soda plants ordinarily varies from $35,000 to $60,000 per million gallons capacity. The chemical costs usually range from $8 to $13 per 1,000,000 gallons per 100 p.p.m. of hardness removed, the higher figure applying for waters high in sulphates (approximately 50% of total hardness).

Zeolite softening usually requires somewhat lower initial investment than the lime-soda process. Its operation requires 0.4 to 0.5 pound of salt per 1000 grains of total hardness removed, the equivalent to 24 to 30 pounds of salt per million gallons for each part per million of hardness removed.

The lime-soda process usually works out lower in annual cost where the hardness is largely carbonate, easily removed with lime. Where sulphate hardness predominates, zeolite treatment, either alone or in com-

bination with lime treatment, is usually indicated.

That soft waters require less soap than hard waters has long been known and various estimates have been made of the economies resulting from soft water. Recently the Illinois State Water Survey under the direction of Dr. A. M. Buswell made a soap use survey in four cities having municipal supplies of hardness of 45, 75, 298 and 555 p.p.m. respectively.* It was found that, beyond a certain minimum of soap necessary with even the softest waters, the soap consumption varies as the hardness of the water. The cost of the soap required is roughly $1 per capita per year for each 150 p.p.m. of hardness above a minimum of say 50 p.p.m.

General

The water now being furnished to the public is of better quality than ever before. Its purity, appearance, taste and chemical makeup can still be improved and the water works profession is working toward that end. As each goal is reached it is found that the demands of the public have become more exacting. The water supplies of today would have been thought ideal a generation ago. Now we aim toward the day when all public water supplies shall be safe, physically attractive, pleasing to the taste and of low mineral content all of the time.

*Buswell & Hudson—Journal Am. W. W. Ass'n. Vol. 24, No. 6

Mechanical Equipment in Sewage Treatment Works

(Continued from page 20)

designed for lifting against low or moderate heads large quantities of water carrying obstructions. The Morris Machine Works makes these with capacities between 3,300 and 120,000 g.p.m., not suitable therefore for any but the largest treatment plants. The other pumps are made with 2-inch to 18-inch suction or larger, and capacities of 100 to 15,000 g.p.m. or more. Most makers state that their pumps will pass solids with diameters about 60 to 75% that of the suction.

Where the pump or ejector is to work automatically in handling amounts varying from hour to hour, the common practice is to provide two or more pumps, electrically operated, with a starting switch operated by a float, so that the second pump is started automatically when the amount of sewage entering the pump well exceeds that which the first pump can handle, and is stopped when the sewage level is sufficiently lower.

A sludge-circulating pump, similar to the Pruess type, is made by M. L. Bayard & Co., in which a propeller revolving in a vertical suction pipe raises the sludge and discharges it horizontally through several ports, which ports as well as the suction pipe are immersed in the liquid; the whole, including the motor, being enclosed in a single vertical casing.

For circulating water through the heating system of a digestion tank, a closed system of piping is generally used in which is inserted, usually at the lowest point in the system, a small booster pump such as a Thrush "circulator."

The space occupied by a Dayton-Dowd vertical pump is, for a 3-inch pump, 20″x20″ horizontal, 48″ vertical, for pump alone; for a 14-inch pump, 46″x46″ horizontal, 105″ vertical. The space occupied by a De Laval horizontal pump, 4″ suction, is 33″x18″ for pump alone, with about 24″ additional length for the motor, and 20″ height; and for a 14-inch, 70″x52″, plus about 50″ for the motor, and 52″ height. Other makes will vary from these dimensions probably not more than 10%.

Reciprocating Pumps

In these, a plunger operates in a cylinder, the sewage entering through one valve or set of valves and leaving through another; or a similar reciprocating action is obtained by means of a diaphragm in the cylinder. The reciprocating motion is obtained by means of a crank shaft, eccentric on the shaft, or a walking beam. In most of them, electric motors are used for power, with belt or gear transmission, and speed reduction by gears.

The walking beam is used by the "Domestic," "Rex" and "Marlow" pumps. The last also uses as an alternative an adjustable eccentric by which the length of stroke can be made anything from 0 to 5¼ inches; and in the Rex also the length of stroke is adjustable. Both are furnished with either plunger or diaphragm, whichever is desired.

The Marlow and Domestic pumps are equipped with rubber ball valves; the Rex with flap type valves. These pumps can operate with a suction lift of 20 to 25 feet, and against a head up to 50 or 60 feet.

In a diaphragm pump, the rubber diaphragm has to be renewed more or less frequently. For one make it is claimed the diaphragm pump has 30% less capacity than the same size with plunger; for another, that the diaphragm requires very much less power for the same volume pumped.

As in the case of centrifugal pumps, freedom from clogging and from rapid wear are most important; and accessibility of the valves for removing obstructions or replacing worn balls or clappers, and adequate lubrication and easy adjustment of packing are desirable.

These pumps are made with 3″, 4″ or 6″ suction, and single or duplex. (The Marlow triplex also.) The 4″ is rated by different makers at a capacity up to from 4,200 to 7,000 g.p.h. for each plunger.

A Marlow 4-inch duplex eccentric requires a foundation 7′ 1″ long by 21″ wide; while the pump, from suction to discharge, is 3′ 6½″ wide by 7′ long. The extreme height is 5′ 4″. The Rex walking beam pump, 4-inch duplex, is 3′ 10″ wide in the clear and 5′ 3½″ long, with an extreme height of 3′ 11″.

Pneumatic Ejectors

A pneumatic ejector consists of a closed air-tight tank into which the sewage flows, an air compressor which delivers compressed air into the top of the tank, a discharge pipe leading from the bottom of the tank, and valves and controls whereby the air pipe is closed while the tank is filling, and this is opened and the inlet pipe closed by a check valve while the tank is discharging. The compressor may be set alongside or above the tank; or, if there are several ejectors, all may be fed by pipes from a single compressor. While the ejector is discharging, no sewage can enter the tank, but provision must be made for accumulating it elsewhere if there is a continuous flow of the sewage. This of course does not apply if discharge is from sedimentation or other tanks.

Pneumatic ejectors are made of any capacity up to 1,500 g.p.m.—possibly larger. Their principal use is for lifting the sewage of large buildings into street sewers. They are seldom used in treatment plants.

The *air lift* was installed a few years ago in a few plants for pumping sludge, but we believe it has not been used in any modern designs.

Highways and Pavements

Trend of Mixes and Specifications For Concrete Street Construction

By E. K. Smith

Assistant Manager, Highways and Municipal Bureau, Portland Cement Association

IN 1928 a study was made of the specifications for concrete paving of 139 cities, and the result set forth in a paper presented before the Am. Soc. of Municipal Engineers. (See PUBLIC WORKS for December, 1928, pages 494-497.) The author planned to make a similar study of the 1932 specifications of the same cities; but so few of the original 139 cities had done any paving for the past two years that only 63 could furnish more recent specifications, the engineers of most of the others stating that new specifications were in process of preparation, but would not be completed until required for new paving contracts.

A study of 1932 specifications shows steady advance in details, especially those that go to make a better pavement and insure that the citizens who pay for it get their money's worth.

Changes in specified proportions provide for denser mixes and greater durability. Whereas in 1928, 9% of the cities required a mix richer than 1-2-3, 11% now require the richer mix. Yet this change has increased quality rather than cost, for only 14% of the cities now call for a minimum of not less than 1.7 bbl. of cement per cubic yard as compared with 29% formerly. The number of cities designing by water-cement ratio or mortar voids (not included in mixes specified above) has increased from 6% to 14%.

A proportionately greater number of cities specify the strengths required or expected to be developed, and require strength and thickness to be checked by taking cores. This is true in small cities as well as large.

Proportioning by weight has increased in favor.

The specification of 1932 that represented the requirements of the greatest number of cities would be as follows:

Materials are to be proportioned by weight whenever practicable, with accurate measurement required for mixing water. Over 14% of the cities were using water-cement ratio or mortar void theory of design. Specified mix in the average city would approximate 1-2-3 with a minimum cement content required of 1.6 bbl. Less than half of the cities state the strength required or expected at 28 days, but additional information indicates that a majority of the cities now attempt to ascertain the strength actually obtained, by specimens cast or cut from the finished work.

Mixing time is specified and a timing device required on the mixer. The slump is specified as not greater than three inches. The pavement is to be finished by striking off, tamping, belting and final check-up with a straight-edge. (The fact that a majority of the cities report the use of tamping in finishing, does not imply that this is becoming more popular for city work. The proportion requiring tamping remains practically the same as four years ago—one of the few provisions where definite sign of change has not been shown.) Nearly half the cities specify the use of a longitudinal float; 68% of the cities either require the use of a finishing machine or permit its use where feasible.

The pavement is to be covered with wet burlap for 24 hours and then with wet earth, hay or straw for approximately 14 days. In a minority of cases 1932 specifications include the use of an admixture or special coating as a curing agent.

Expansion joints are to be provided in this average city pavement, but only about one-fourth of the cities use contraction joints between them. Longitudinal joints of some form are standard.

1932 city practice seems about equally divided regarding the use of reinforcement.

Of course, some cities showed wide variation from the average above, where bad subgrades prevailed or available aggregates presented some unusual characteristics. Poor aggregates are usually given today as the only reason for building a two-course pavement.

1932 specifications showed certain general tendencies:

First, to obtain more accurate control, by weight proportioning of all aggregates and water, reducing the effect of "bulking" to a minimum.

Second, getting away from fixed volumetric proportions by loose measure, and specifying carefully designed mixes by dry rodded volumes (proportioned by weight).

Third, allowing the engineer to make minor adjustments in the proportions, in the interest of maximum yield to the contractor and maximum workability (and durability) in the interest of the city, minimum cement content usually being specified.

Fourth, general recognition of the importance of accurate water control, as affecting both strength and quality of concrete, and the use of the slump test as rough indication of changes in grading or water content, affecting workability.

Fifth, while not especially noted in this study, the increased attention given to the construction and placing of expansion, plain, contraction and dummy joints, longitudinal and transverse, with proper use of dowels and tie-bars, is already resulting in better pavements.

Sixth, with better control of quality and changes in standard cement specifications has come definite reduction of the time that new pavement is closed for curing.

A few years ago high early strength concrete was used in only a few cities. In 1932 40% of the cities provided for high early strength concrete, with standard or special cements for use wherever the extra cost (if any) is justified.

Now, when municipal construction is temporarily at a low ebb, is the time to study the grading and characteristics of the aggregate in your local market, and make any necessary revision of city specifications in the interest of economy and improved quality. Very few cities are over-built in pavements, even now, and street improvements will come among the first with the resumption of normal construction programs.

The above is an abstract of a paper before the American Society of Municipal Engineers.

Rental Rates for Snow Removal Equipment in North Dakota

The North Dakota Highway Department, in cooperating with the counties on snow removal, reimburses the counties for the use of trucks and tractors as follows: Tractor, 50 horse power or greater, and large snow plow. (Includes both tractor and snow plow operator.) $5.00 per hour.

Four wheel drive truck, 3 ton or larger, and snow plow. (Includes both truck and snow plow operator.) $3.50 per hour.

Rear wheel drive truck, 3 ton or larger and snow plow. (Includes both truck and snow plow operator.) $2.00 per hour.

On through highways, the total cost to the state is limited to $25 per mile; and on less important highways of the state system to $10 per mile. Equipment must remove snow from the full width of the highways as the work progresses.

Employee or Independent Contractor?

The principal test as to whether one rendering services for another is an employee and not an independent contractor is said to be whether the employer has the right of control with reference to the details of the work. This is the dominant test, although there are other things to be considered, such as the place of the work, the time of the employment, the method of payment, and the right of summary discharge of employees. It has been said that the status of an independent contractor is the more readily inferable where the contract calls for the performance of an entire piece of work at a specified price. A road contractor sublet the contract of building a main road to another contractor, Bent, who was equipped with the necessary heavy machinery, and undertook the branch roads himself. Not having heavy enough machinery for the branch roads, the road contractor arranged with Bent for the use of his crew and tractor for the completion of these roads. During the work, Bent sustained injuries while blasting, causing his death. The question whether his widow was entitled to an award for his death as an employee of the road contractor was decided by the Wisconsin Supreme Court in the affirmative. Habrick v. Bent, 227 N. W. 877.

Small Shovel Handles Heavy Rock Work

Late last fall the highway department of the State of Ohio completed building as a low-cost gravel road about seven miles of State Route No. 148, in Belmont county along the Ohio river. This job, handled out of State Division Office No. 11, in charge of Charles E. McKee, division engineer, was superintended by Henry H. Renner, state highway superintendent.

The excavating was done by a ½-yard shovel which the State had purchased recently. It made all the

Byers Shovel working in limestone ledge

deeper cuts and in soft materials excavated an average of 600 yards per day, loading three 3-yard trucks and one 2-yard, which carried dirt to fills. When pushed, the shovel was able to make as many as 36 truck loads per hour.

When a limestone ledge 10 ft. x 25 ft. and 500 ft. long was reached, the question arose as to whether a ½-yard shovel could dig this blasted mid-rock, much of which was in chunks too large even to ride on top of the dipper. However, as the shovel was already on the job it was decided to let it try the rock, and it was found able to handle it. It dug and cast this heavy material, recasting much of it over a bank on one side of the road. The larger rocks, those more than 36 inches in diameter, were swept sideways over the bank by the shovel dipper while the machine was swinging. Four weeks were consumed in handling this ledge.

Russell Cookson, state highway shovel operator, handled the machine used on this work—a Byers Model 60.

What Becomes of the Calcium Chloride on Roads?

Three roads, in South Carolina, Missouri and Nebraska respectively, were studied last year, chiefly with a view to learning what becomes of the calcium chloride used as a dust palliative on gravel roads. The findings, as reported to the Highway Research Board by Fred Burggraf, research engineer of that board, are briefly as follows:

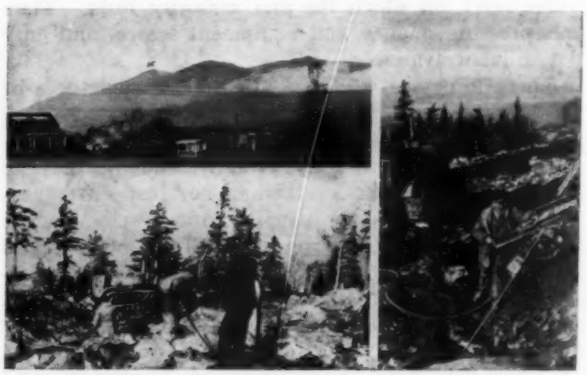
Although chemical reaction with the soil and effects of rainfall account for some of the loss, the principal source of dissipation of the calcium chloride was found to be in the maintenance manipulation of the loose coarse material on the surface of the road. These findings were checked by comparative observations on roads maintained in the usual way by frequent drag-

ing of appreciable amounts of loose material back and forth across the surface, and experimental sections upon which discontinuance of maintenance manipulation on the surface allowed the traffic to compact all of the loose, damp material.

Heavy Work on Highway Up Whiteface Mountain

Starting at a point on State Route No. 86, just at the edge of the town of Wilmington, New York, eleven miles from Lake Placid, the World War Veterans' Memorial Highway to the top of White Face Mountain is being rapidly pushed to completion. Winding through heavily wooded gorges and along the rugged slopes of old White Face, this highway will be of the greatest scenic interest.

It will have a minimum width of 30 ft. and an average grade of 9%. Its base will be the solid



Views on the Whiteface Mountain job

granite of the mountainside, and rock fill supported by retaining walls built of blocks of stone removed from the right of way in excavating. The final surface will be water-bound macadam.

As might be expected, the amount of rock removal is enormous. The drilling operations involve sinking, pop-holing, drifting, or "snake-holing," and some holes which are so elevated that they might be referred to as "stoping." These last are drilled parallel to the natural lines of cleavage of the granite, and the holes are loaded and shot in such a way as to "lift" the stone with comparatively little shattering so that the blocks may be used for construction of retaining walls.

It is expected that the road will be dedicated and opened to the public in August, 1933. Williamson Howard Construction Company of Youngstown, Ohio, are the contractors.

Vehicles Injuring Surface of Highway

Under the Maine statute requiring a permit to use a vehicle having a flange likely to injure the surface of the highway, a flexible band known as a moveable track attached to a gasoline shovel would not bring the use of the shovel within the statute without proof by the state that its connection with the shovel or the equipment taken as a whole was likely to bruise or injure the surface of the way. State v. Hughes (Me.) 152 Atl. 315.

ON PAGE 47 .....

On page 47 you will find a special service department for readers of PUBLIC WORKS who want literature covering the very latest developments in equipment and materials used in the construction of public improvements.

Some Offspring of Mother Necessity

"Engineer" is said to be derived from the Latin word meaning ingenious; and to many engineers there is a fascination in work which calls for ingenuity—work which has never before been performed with the resources which he can command. Such work was carried out by an English engineer, J. R. Paris, in building a bridge to connect the Port of Kilindini, East Africa, on the island of Mombasa, with the main land, to carry a one-meter gauge railway track and a 30-foot motor road.

The waterway to be bridged was 1296 ft. wide, with ordinary spring tides of 15 feet rise. The bridge portion was 300 ft. long, the balance of earth embankment. There is 28 ft. headway under the bridge floor at high tide. The bridge was made in five 60 ft. spans, supported on masonry piers built on concrete cylinder piles; three piles to a pier, each 12 ft. diameter, capped with a single concrete slab at high water level, on which the pier masonry rests. Time was pressing, money and equipment scarce, and only native labor available.

The pile driver, with a 500 lb. hammer, had to be operated by hand, using three gangs of eight natives each to wind up the winch. It was found that a 5 ft. drop was all that the piles would stand, but how to teach the natives to raise the hammer just 5 ft. was a problem. The natives usually sing a chant when working, and a chant was selected which, if begun when the winding began, would have raised the hammer just 5 ft. when the chant ended. This worked perfectly. For sinking the foundation cylinders, dirt was dumped at the site of each pier to form an island to guide the cylinders and afford support for the cranes which removed the dirt from inside them. For forms for the cylinders, steel plates were used 4 ft. high, the inner one 7 ft. diameter, the outer 12 ft. The concrete was mixed 1-2-4 and allowed to set 24 hours before the forms were raised. Dirt was removed from inside the cylinders by grab buckets, but there was no pump available for removing the water. As a substitute, two coal tubs, each holding 300 gallons of water, were fitted with 18-inch mushroom valves in the bottom and, when lowered into the well, the valve opened and the tub filled; the tub was then raised and deposited on a platform alongside the well, when the valve opened automatically and the water ran out into the stream. In this way the deepest cylinder (56 feet long) was emptied in three quarters of an hour at low tide.

Most of the plant that was available had to have more or less extensive repairs.

Two incomplete swing-derrick cranes were rebuilt as to timber by using 12 in. by 12 in. pitchpine, all being sawn up by hand on the job. One complete hand-winch gear was made out of two. One complete steam winch was made out of two old ones, and a small loco boiler used to supply it with steam, thus making a swing derrick, which was minus hand gear, into a steam derrick.

An old hand-fed ½ yd. concrete mixer was found and fitted with an electric motor, but the hand feeding was unsatisfactory, so, by raiding the scrap heap once more, two old motor-car clutches and an old gear box were made into a unit and the mixer turned into a mechanical loader. This worked day and night for seven months without a breakdown. A small ⅛ yd.

gasoline-driven mixer was procured and used in the block-making shed.

The only engineers' tools were a blacksmith's shop, a hand ratchet, and hand tools. A sort of lathe was made out of wood, and the work turned with the cord of a native bow (the bow of a bow and arrow). On this were made three valve-guide spindles for the steam shovels, made out of old Ford back-axle shafts. The work was swaged to size by the blacksmith and finished off with a file on the home-made lathe. All conversions of plant, maintenance and repairs were carried out on the job.

Tractor-Scraper Units for Gravel Pits

In operating a gravel pit near Clear Lake, Ia., Beu & Sons used two "Thirty" tractors with one-yard scrapers, and a "Fifty" with a 50 cu. ft. Automatic Roll-over scraper. In removing top soil, the larger unit carried approximately 2 yards each trip and averaged a round trip every three minutes over a 225-foot haul. The two smaller units averaged a little more than 1 yard a trip, and 2¼ minutes for a

One tractor scraper furnishes all the gravel for a crusher at the Walter Stussy gravel pit

round trip. After removing the top soil, these units were used for hauling gravel and rock to the crusher.

Two of these scrapers of 42 cu. ft. capacity, used by W. K. Hodgeman & Sons in moving 10,000 yards of gravel in Minnesota, averaged approximately 50 yds. an hour apiece. They find advantages of tractor-scrapers for gravel pit work to include the ease with which it can be backed up the side of the pit and turned in short quarters, the quickness with which it can be dumped, and the surplus load that can be dragged ahead of the scraper.

Iowa Rates Roads as Its Highest Asset

Iowa's system of modern pavement is given first place among the state assets listed in the consolidated report of Oscar Anderson, state budget director.

Of a total figure of $344,350,165, embracing all of Iowa's tangible assets, the State's primary road system is valued at $233,681,744—or better than two-thirds of the whole amount. Buildings, of various sorts and under the jurisdiction of the several state departments, rate second place among the listed assets, with a total valuation of a little more than forty million dollars. Next in order is the item of furniture and equipment, followed by the entry for land.

State highways, according to highway officials, are not only primary assets on the books of the state, but are active assets in that they tend to refund the gas taxes paid by motorists by reducing motoring costs and increasing the use and life of motor cars.

For latest catalogs—consult the *classified* INDUSTRIAL LITERATURE section, beginning on page 47

Sanitary Engineering

Water Supply — Sewerage — Refuse Collection and Disposal—Sanitation

Model Water Department Cost Accounting System

A COST accounting system comprehending all operations handled by the public works and water departments has been installed for the City of Newport, Ky., by the city manager, Clyde E. Wallingford, with the assistance of the Committee on Uniform Street and Sanitation Records. It is believed that these records will be a valuable aid in estimating costs of proposed improvements, and they will be used as a basis for estimating departmental expenditures in scientific preparation of the city budget.

During the year the city also adopted an excellent centralized purchasing plan and a water work billing system, which furnished a foundation for the cost records system. The system installed embraces all field reports for recording labor, materials and supplies used, equipment costs, and units of work done. All of these daily reports are brought together in the central city office under the direct supervision of R. J. Rohde, the city treasurer.

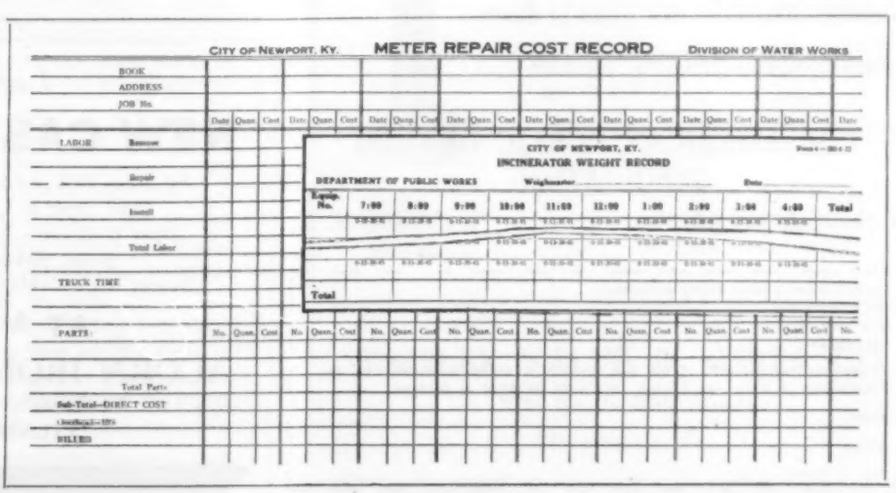
A central equipment maintenance division under the direct supervision of the city engineer, A. H. Root, repairs all major city-owned equipment, and bills the several departments monthly for these repairs. The bills for repairs to public works and water department equipment are based on hourly rental rates. Other departments, such as police, fire, etc., are billed at actual cost for labor and parts, plus garage overhead.

As a basis for such bills and also to give accurate costs of operating all city equipment, the standard individual equipment record of the Committee on Uniform Street and Sanitation Records is maintained. Once each month, City Manager Wallingford receives a report summarizing the equipment records which shows the total cost of operation, the cost per hour, and the cost per mile for each piece of equipment. This report also reveals the maximum hours that each piece of equipment should be operated on full-time schedule, the actual hours operated, and the per cent of efficiency in the extent of its use.

The daily field reports are employed by city officials for day-to-day control as well as for accumulating monthly or job cost figures. One of the most interesting forms is the Incinerator Weight Record, Form 4, which is patterned after the weight record employed by H. W. Fleddermann, superintendent of streets at Louisville, Kentucky. A separate record is prepared by the weighmaster for refuse disposed at the incinerator and at the dump. Both are located at the same central point in the city. The weighmaster indicates with a check the time to the nearest fifteen minutes that each load arrives at the point of disposal. The last column on the right-hand side provides the total pounds hauled by each piece of equipment. The totals across the bottom of the form (the form contains ten lines, of which only three are shown on the reproduction) show the amount of refuse arriving at the point of disposal for each hour during the day. Thus the record serves as a very good administrative report in planning routes and incinerator loads.

The water works department uses two new forms; one a foreman's daily gang report, which provides columns for the foreman to show the amount of labor and materials used on each job or type of work. The second form (which is reproduced here) is a Meter Cost Record. In Newport, as in a great many other cities, property owners must pay all costs for meter repairs, and each meter cost record is arranged so that the costs of repairs to ten meters may be assembled on one sheet. At the top of the form is given the book number of the account, the address of the property, and the number assigned to each particular meter repair job. The costs of parts used is entered in the center of the record. Ten per cent is added for overhead to the total direct costs for each meter repair job. The date the account is billed is inserted at the bottom of the record. The labor costs of removing, repairing, and installing the meter after repaired are kept separately.

Seven daily field reports furnish all the basic information for the entire system in both the public works and water departments. Each of these daily reports goes first to the garage where the timekeeper's office is located. There a master time book is


CITY OF NEWPORT, KY. METER REPAIR COST RECORD DIVISION OF WATER WORKS

BOOK
ADDRESS
JOB No.

LABOR: Remove, Repair, Install, Total Labor
TRUCK TIME
PARTS
Total Parts
Sub-Total—DIRECT COST
BILLED

CITY OF NEWPORT, KY.
INCINERATOR WEIGHT RECORD
DEPARTMENT OF PUBLIC WORKS

Equip. No.	7:00	8:00	9:00	10:00	11:00	12:00	1:00	2:00	3:00	4:00	Total
Total											

Forms used by Newport, Ky. for meter repair costs and weights of refuse received at incinerator.

Meter record form contains 10 horizontal lines under the heading "Parts." Incinerator form contains horizontal lines for 12 pieces of equipment.

For latest catalogs—consult the *classified* INDUSTRIAL LITERATURE section, beginning on page 47

maintained and all labor reports are checked against this master time book before it is delivered to the city hall office. At the city hall office, the reports for material, labor, and equipment are summarized and eventually reach the work and cost ledger. From this ledger evolve all of the work and cost statements used for administrative control of both public works and water department operations.

This installation was made under the direction of Donald C. Stone and Gustave A. Moe of the research staff of the Committee on Uniform Street and Sanitation Records and the International City Managers' Association.

Estimating Cost of Sewage Treatment

STATING the cost of a sewage treatment plant, or estimating the cost of a proposed plant, in terms of cost per capita or per m.g.d. does not allow for the many differences in the capacities required in different communities or estimates for future requirements. For example, a plant of one m.g.d. capacity costing $100,000, would cost $10 per capita on the basis of 100 gallons per capita, but $15 on the basis of 150 gallons. Again, a plant designed to provide a longer settling period than another, or with more suspended matter (including trade wastes), or providing for greater anticipated growth, would cost more per capita or per m.g.d., other things being equal.

The best method of estimating cost in advance of construction is from a carefully prepared statement of the material quantities required, taken from the detail plans. But a preliminary estimate is commonly desired before the detail plans have been worked out, and a method of computing a preliminary estimate on the basis of cost per unit of volume or capacity for each major structure, based on the costs of similar structures in completed works, was explained by Samuel A. Greeley in a paper before the Am. Soc. of Municipal Engineers. Such a method includes allowance for many miscellaneous items which might otherwise be overlooked, and has been found by him to be relatively quick, easy and accurate.

The major elements in an aeration plant he lists as: A—Primary settling tanks. B—Aeration tanks. C—Operating galleries. D—Final settling tanks. E—Blower building, including equipment. F—Administration building. G—Sludge handling plant, including digestion tanks, storage tanks, drying beds, sludge pumping stations and the like. H—Outside piping, sewers, conduits, etc. I—Miscellaneous items, such as water supply, roads, landscaping, etc. J—Engineering and contingencies. K—Land for site.

A. The cost of a primary settling tank is stated in cost per cubic foot of effective volume, including all appurtenances within the outside lines of the footings. This will vary with the size of the tank. At Grand Rapids this cost was 54 cts.; at Peoria, 60 cts.; at Rockford, 42 cts. Seven 60-foot tanks cost 66 cts. in 1924-1929; and three averaged 43 cts. in 1931 and 1932. Plotting costs, curves are obtained indicating a present range of 60 to 70 cts., where the area of the tank is 2,000 sq. ft.; 47 to 53 cts. where the area is 3,000 sq. ft.; 39 to 45 cts. for 4,000 sq. ft. area; 34 to 41 cts. for 5,000 sq. ft.; 31 to 38 cts. for 7,000 sq ft.

For settling tanks of the two-story type, the unit cost is obtained by dividing the total cost by the sum of the

settling and sludge digestion capacities; but the unit is less definite because of the effect of depth of excavation and varying gas vent spaces. This unit cost was 93 cts. at Worcester, 76 cts. at Akron, and 59 cts. at Hinsdale.

B—The cost of aeration tanks per cubic foot at Peoria was 29 cts., without the operating gallery.

C—Trickling filter cost depends in part on cost of aggregate, and is less for a deep than for a shallow filter. The acre-foot unit is convenient, and at Akron was $11,670, and $14,267 at Hinsdale.

D—Final settling tanks cost 38 cts. per cubic foot at Peoria, 65 cts. at Akron, 35 cts. at Hinsdale.

G—Digestion and storage tanks, sludge beds, pumps, etc. vary in cost with amount and kind of equipment, kind of cover, etc. The cost of digestion tanks per cubic foot at Grand Rapids was 44 cts.; at Peoria 30 cts.; at Rockford (without mechanism) 27 cts. Storage tanks cost less—in some plants much less. Sludge drying beds cost 35 cts. per square foot at Grand Rapids, 38 cts. at Peoria, 72 cts. at Akron, 64 cts. at Hinsdale, 29 cts. at Rockford.

There is no convenient unit for estimating cost of the other general items, but "a guide to the cost of these items results from a computation of the percentage that they have amounted to in other treatment plant costs. Operating galleries, blower plants and the like we have computed on the basis of the unit cost per million gallons per 24 hours of rated plant capacity."

SUGGESTED METHOD OF STATING

CONSTRUCTION COSTS OF A SEWAGE TREATMENT PLANT

(*Typical Basis taken as* 100,000 *people and* 10.0 *M.G.D.*)

1.	Inlet facilities and measuring devices	$25,000
2.	Primary settling tanks—1.5 hours displacement period—84,000 Cu. Ft. @ $0.50	42,000
3.	Aeration tanks—6 hours of sewage flow plus 20% return sludge—400,000 Cu. Ft. @ $0.35	140,000
4.	Operating gallery—10 M.G.D. @ $6,000	60,000
5.	Final settling tanks—800 gallons per sq. ft. per 24 hours, 15 ft. deep—188,000 cu. ft. @ $0.45	85,000
6.	Blower plant—10 M.G.D. @ $5,000	50,000
7.	Administration building and laboratory	35,000
8.	Sludge handling	
	Digestion—1.5 cu. ft. per cap.—150,000 cu. ft. @ $0.30	45,000
	Storage—1.0 cu. ft. per cap.—100,000 cu. ft. @$0.15	15,000
	Pumping stations, heating plant and connections	40,000
	Drying beds—0.75 sq. ft. per cap.—75,000 sq. ft. @ $0.35	26,000
9.	Outside piping and water supply, roads and grounds, and miscellaneous	80,000
		$643,000
10.	Engineering and contingencies	87,000
	Total Estimated Construction Cost	$730,000
11.	Land—20 acres @ $1,000	20,000
	GRAND TOTAL	$750,000

An Unsafe Well in "Solid" Rock

During the summer of 1932 a very modern public school was built in Westchester County, New York, and water for it obtained by drilling a well 500 feet deep, the entire well from the surface to the bottom being core-drilled through what is commonly called solid rock. A 16-foot length of casing was sealed into the rock just under the concrete pump pit.

During the final period of test pumping an analysis of the water by the County Health Department showed it to be heavily contaminated with "organisms of sewage origin." The department's engineers found that there were, in the vicinity of the well, a number of cesspools whose use had been discontinued less than a year before, upon the completion of a public sewer system. Undoubtedly cracks or fissures in the rock connected these with the well.

A new casing smaller than the old was inserted through it to a depth of 95 feet, but this did not stop the contamination. Then all the cesspools in the neighborhood were thoroughly cleaned and treated with large quantities of chloride of lime. Meantime use of the well water was discontinued and bottled water used in the school. During the next three months, bacteriological examinations showed a gradual reduction in contamination and finally indicated that the water was safe for use.

Sufficiency of Storm Water Sewers

In constructing or repairing its highways, the Connecticut Supreme Court says, Spitzer v. City of Waterbury, 113 Conn. 84, 154 Atl. 157, a municipality is engaged in the performance of a governmental duty. A duty which is imposed by statute or charter upon a municipality to maintain the highways within its limits makes it necessary for the municipality to dispose of all surface water falling upon them. Storm water sewers, which carry off the surface water from the streets of a city, it is held, are adjuncts of a highway and partake of its nature as a governmental use.

The work of constructing drains and sewers, as well as that of keeping them in repair, is ministerial, and the municipality is responsible for negligence in its performance. But if the drains and sewers of a municipality are amply sufficient to meet all demands upon them under ordinary conditions, the municipality is not liable because they may prove inadequate to carry off the surplus waters from an extraordinary storm or flood.

In this case an unusual and almost unprecedented rainfall caused the storm water system draining the highway near the plaintiff's house to overflow and flood the streets and their cellar. The entire storm water system of the city in the area was found to be of sufficient size and construction to carry off such rainfall as would ordinarily be expected. The city was therefore held not liable.

Sludge Beds Maintenance and Not Construction

The Connecticut Supreme Court holds, Davis Holding Corp. v. Wilcox, 153 Atl. 169, that the word "maintenance" within the statute providing for the construction and maintenance of a sewer system was not limited to the mere repair of disposal works and their preservation in the condition in which they were left after the original construction. The construction of concrete sludge beds for a sewer to prevent offensive odors was held to be an item of the maintenance of the sewer rather than the original construction, and the cost thereof was dealt with accordingly.

Standard Methods for the Examination of Water and Sewage

The American Public Health Association announces a new edition of "Standard Methods for the Examination of Water and Sewage," prepared in cooperation with the American Water Works Association. The previous edition is dated 1925. In the new edition, the Seventh, many important additions and changes occur. As examples, the method for total hardness has been extensively revised; the ortho-tolidine test for chlorine is presented more exactly; the determination of the biochemical oxygen demand has been rewritten; the use of brilliant green lactose peptone bile is allowed in conjunction with standard lactose broth for water purifica-

tion plant control; twenty-three methods of analysis, which are not yet recommended as standard procedures, but which may be of use, are presented in abstract and with references. The new edition, the price of which is $2.00, may be purchased from the American Public Health Association, 450 Seventh Avenue, New York, N. Y.

Elevated Tank Reduces Pumping Power Consumption

The village of Glencoe, Ill., reduced the power consumption of its water works department 32 percent by installing a 500,000-gallon elevated tank, according to Alvord, Burdick & Howson, consulting engineers, and George R. Young, village manager, says the "Water Tower," which furnishes the following substantiating facts:

During 1931 the electric pumping plant consumed energy varying from 40,000 k.w.h. to 80,800 k.w.h. per month, or from 1,400 k.w.h. per million gallons pumped to 2,280, with a weighted average of 1,835 k.w.h.

Early in 1932 the tank was built and put into service, but was taken out of service for painting and put into regular service June 25th, since when it has been continuously in service. During six full months with the tank in continuous service the k.w.h. varied from 1210 to 1280 per m.g., with an average of 1,235 k.w.h. There is thus a saving in power of more than 32 per cent. Moreover the consumption is more uniform, varying only approximately 6% as compared to 63% in 1931.

The explanation of the saving is as follows: The pumping plant consists of a 1 m.g.d. pump, a 2 m.g.d. and a 4 m.g.d. pump, all electrically driven centrifugal high-lift, and a 4½ m.g.d. gasoline-driven stand-by unit. Also, for supplying the filter plant, two motor-driven, low-lift 2 m.g.d. pumps and a gasoline-driven 3 m.g.d. stand-by unit. Before the tank was used it was necessary to vary the delivery of the pumps as the consumption varied; the low-lift as well as the high-lift, to keep the clear well (which furnished the only storage) as full as possible. Now one large pump can be operated for a few hours at a uniform rate of high efficiency, and is shut down entirely for about half the time.

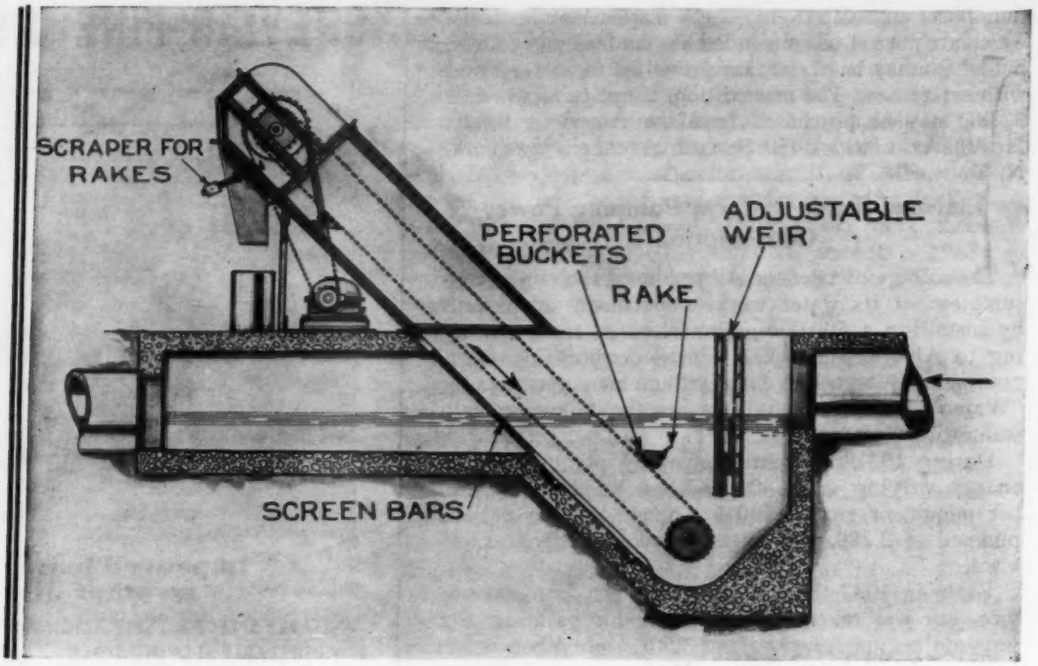
In addition to the economy, the elevated tank doubles the filtered water storage capacity for peak loads, maintains uniform pressure throughout the system, and guards against interruption of service in case of temporary power supply failure.

Completing the Longest Continuous Gravity Sewer in the United States

(Continued from page 10)

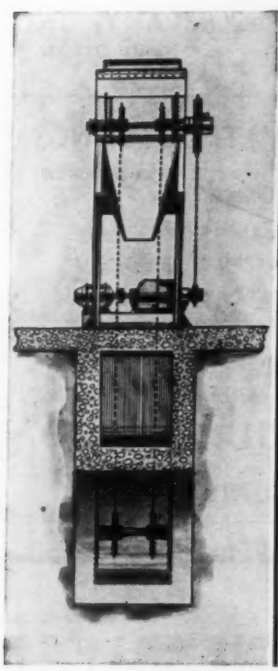
Section E, for vitrified clay pipe, and F, for centrifugally cast concrete pipe, were constructed below ground water level and in some parts of Section E in yielding sandy soil. However, by using large shields on the trenchers, sheeting the trench tightly and placing crushed rock 1 foot to 3 feet deep as subgrade, and removing the water from this subgrade by pumps stationed about 60 feet apart, it was possible to lay the pipe in a dry trench.

This project has been designed under the direction of J. J. Jessup, city engineer; H.P. Cortelyou, design and construction engineer; H. G. Smith, sanitary sewer design engineer; L. O. Turner, district engineer, and S. S. Ball, district sewer design engineer.



The type "C" STRAIGHTLINE Screen

(Patents Pending)



A COMBINED SCREEN AND GRIT CHAMBER

A NEW, yet tried and proved unit—especially designed for medium and small size plants, where the cost of separate mechanically cleaned units might be prohibitive. The type "C" screen is adapted for continuous or intermittent operation.

Its main elements consist of a hopper, a bar screen with approximately 1 inch openings, and a bucket elevator for the dual service of removing the grit from the hopper, and cleaning the bar screen.

Regulation of the currents through the hopper, is made by two baffle plates near the influent end, one adjustable downward and the other upward, to permit settling of the grit, and prevent settling of the organic matter. The upper baffle allows part of the flow to pass over it.

The lips of the elevator buckets are provided with rake teeth, which engage with and clean the screen bars on their downward travel. The buckets are perforated, permitting the water to drain out, while they carry the grit and other accumulations up, to discharge into a suitable container or trough for removal.

This equipment fills a long felt want in the smaller size plants.

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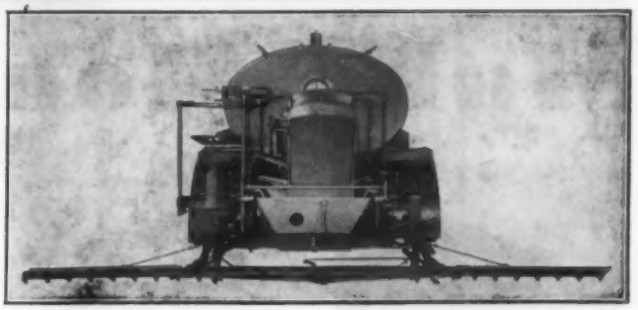
For latest catalogs—consult the *classified* INDUSTRIAL LITERATURE section, beginning on page 47

Developments in Bituminous Distributors



The new Etnyre distributor, shown here ready to operate, is described fully below.

Kinney Distributors and Distributor Unit

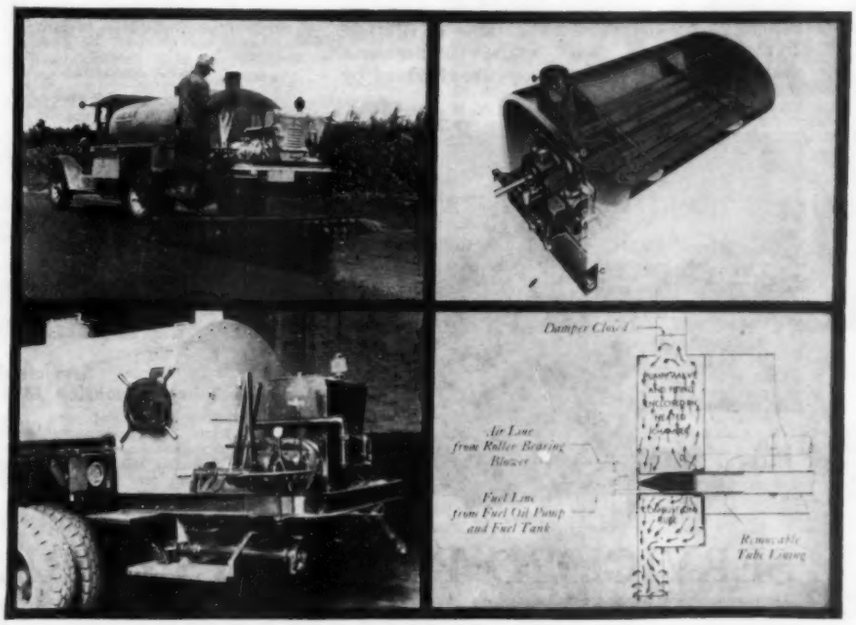
Many improvements in the Kinney line of distributors will be announced in a new catalog which will be ready for distribution the latter part of this month. This catalog will describe Kinney distributors in sizes from 600 to 1700 gallons, with the Kinney jacketed pump, which has a capacity of over 400 gallons a minute. This gives high pumping rates, and since road speeds are necessarily in direct proportion to pump output, higher road speeds are possible.

The catalog will also show a new Kinney unit, a distributor with no tank, but mounted on a two-wheel trailer. This outfit is designed to be used behind supply tanks, attached by a flexible hose connection. With this device, it will be possible to keep the distributing unit on the job at all times and bring the supply trucks to it, thus materially cutting down transportation costs on long hauls.

Copies of this new catalog and information on the equipment described may be obtained from PUBLIC WORKS or from the Kinney Mfg. Co., Washington Street, Boston, Mass.

Improvements to the Littleford Distributor

The bituminous distributor is an essential for low cost road construction. Some of the forthcoming improvements of such distributors were mentioned in the January issue of PUBLIC WORKS. Littleford Bros. Co., Cincinnati, O., have announced the outstanding features of their distributor to be: Single valve control of all operations; complete control from the operator's platform; low pressure burner that lights instantly without preheating; heat chamber that encloses pump, valve and all pipe lines assuring quick starting always; the heat deflector to preheat operating mechanism; and the continuous type heat flue, giving maximum efficiency. Some of the details of construction are shown in the accompanying illustration.



Showing details of the Littleford pressure distributor.

Developments in the Etnyre Distributor

E. D. Etnyre & Co., Oregon, Ill., offer on their new distributor a shifting, circulating spray bar. This device stops the drip from the nozzles after spraying, and is of the circulating type, with a valve at each nozzle. The spray bar is supported on universal brackets, so that it can be raised, lowered, and swung 9 inches to the right or left of center. This distributor also has a simplified control through a single lever. A two-speed tachometer has been developed which is used only when spraying. An illustration of this equipment is shown herewith.

Austin Distributors

Bituminous distributors are made by the Austin-Western Road Machinery Co., 400 North Michigan Ave., Chicago, Ill., in sizes from 600 to 1500 gallons, to handle all grades of tar, asphalt, oil and emulsions. These can be mounted on any standard truck or trailer chassis without altering the cross-braces, supports, etc. These units were described briefly in these pages some time ago, and a brief outline of 1933 improvements appears on page 49 of this issue.

Publications You Ought to Have:

Brick Pavements, recent practical developments in design and construction, has just been issued by the American Road Builders' Association. Hal G. Sours, County Engineer, Summit Co., O., is chairman of the committee which prepared this valuable information. 17 pages. . . . *Diesel Engines* are described in Bulletin P-3200, of the Power Manufacturing Co., Marion, O. . . . *Low Cost Road Construction* with Caterpillar tractors and road machinery is a really excellent 48-page booklet which gives a whole lot of technical information on road building.

For latest catalogs—consult the *classified* INDUSTRIAL LITERATURE section, beginning on page 47

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★ *It is a good practice to check this list regularly because descriptions of new bulletins are always being added.*

Construction Materials and Equipment

Asphalt Heaters

8. A 32-page general catalog issued by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio, describes and illustrates their complete road maintenance line, including tar and asphalt kettles, surface heaters, oil burners, sand dryers, tool boxes, lead and compound furnaces, tool heaters, asphalt tools, joint and crack fillers, squeegee carts, etc.

9. Illustrated manual No. 11 describes "Hotstuff," the master oil burning heater. The only heater with patented elevated melting chamber for Asphalt, Tar and all bitumens used in road and street construction and maintenance, roofing, water proofing, pipe coating, etc. Mohawk Asphalt Heater Co., 94 Weaver St., Schenectady, N. Y.

Asphalt Plants

10. Portable Asphalt Paving Plants. These R. R. 1-car plants have easy capacity of 2,250 yards, 2" surface per 8 hours. Cheap to operate. J. D. Farasey Mfg. Company, Cleveland, Ohio.

Concrete Accelerators

30. "How to Cure Concrete," a forty-seven page manual published by the Dow Chemical Company, Midland, Michigan, treats fully subjects suggested by title.

31. "Curing Concrete Roads with Solvay Calcium Chloride," 30 page booklet. Comprehensive. Contains tables, illustrations, suggestions for testing devices. Covers the subject in considerable detail. Solvay Sales Corp., 61 Broadway, N. Y. C.

35. "A report on Current Practice of using Calcium Chloride for curing Concrete Pavements, Bridges, Culverts and Concrete Products." It includes reports from the Highway Research Board, the Bureau of Public Roads and State Highway Departments. Columbia Products Co., Barberton, Ohio.

Concrete Mixer

44. Concrete Mixers, both Tilting and Non-Tilting types, from 3½s to 84s size, The Jaeger Machine Company, Columbus, Ohio.

Crushers

57. Up-to-date information on Stone Crushers, Stone Spreaders, Unloaders, Drags and other contractors' equipment from the Galion Iron Works & Mfg. Co., E. Jeffry, Mfg. Co., Columbus, Ohio.

Culverts

60. "In diameters up to 10 feet and larger . . ." just issued by the Armco Culvert Mfrs. Assn., tells a good deal about drainage problems and their solution. 32 pages about drainage and multi-plate culverts.

Explosives

74. "Use of Explosives for Settling Highway Fills." A new booklet which fully explains by diagrams and charts the three methods developed after many tests by the Du Pont engineers, which singly or in combination will quickly and efficiently do your job. Just issued by E. I. Du Pont de Nemours & Co., Inc., Explosives Dept., Wilmington, Del.

Graders

76. Latest information about Galion Motor Patrol Graders, Road Maintainers and Leaning Wheel Graders with hydraulic control is contained in a new series of illustrated catalogs, Nos. 125, 130, 135 just issued by the Galion Iron Works & Mfg. Co., care of The Jeffrey Mfg. Co., Columbus, Ohio.

Hose and Belting

87. Complete information on rubber hose and belting for all types of contracting and road building service. The Government Sales Department of the Goodyear Tire & Rubber Co., Inc., Akron, Ohio.

Joint Filler and Line Marker

88. Bulletin No. G-9 issued by Littleford Bros., 452 E. Pearl St. Cincinnati, Ohio, describes and illustrates their new No. 91 Joint Filler which is used to fill horizontal and center joints with hot asphalt. It can be equipped to apply an asphaltic center line as it fills the center joint. This bulletin also describes the Littleford Traffic Line Marker.

Joint Filling Pot

89. A supplement to Bulletin No. E-5 has been issued by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio, describing their cone-shaped crack filling pot No. 86-B. The chief feature of this pot is that it is springless—there is no mechanism to get out of order. It is used to fill cracks and joints in concrete pavements and interstices in brick or granite block pavements.

Lanterns and Torches

90. Dietz Lanterns and Road Torches adapted for night traffic warning on any construction work that obstructs the highways. R. E. Dietz Co., 60 Laight St., New York, N. Y.

Loaders and Unloaders

97. Portable Loaders and Unloaders. Folders: Nos. 1248, 1298 and 1074 cover Belt Conveyors with channel iron and truss types of framework; No. 1076, Portable Bucket elevators for different classes of work; and No. 1256, the "Grizzly" Crawler Loader for heavy work and large capacities. Link-Belt Company, Philadelphia

100. Materials Handling and Positive Power Transmission Equipment, giving technical data, list prices and illustrations of this machinery. Link-Belt Co., Chicago, Ill. General Catalog No. 500.

Motor Trucks

105. A new line of heavy duty motor trucks and tractors for dump and commercial hauling is described in literature recently issued by the Sterling Motor Truck Co., Milwaukee, Wis.

106. "Trucks for Public Utilities," is a new illustrated booklet just issued by the International Harvester Co., 606 So. Michigan Ave., Chicago. Covers uses, types, special equipment, bodies and specifications. Sent free on request.

Paving Materials

109. A 36-page booklet with 66 illustrations has just been issued by the Barrett Co., giving full information regarding the making, laying and maintaining of "Tarvia-lithic," the ready-to-lay pavement.

111. "Tarvia Double Seal Pavements." Shows, step by step, the construction of a Tarvia pavement. 24 pages. The Barrett Company, 40 Rector Street, New York.

112. Complete directions for surface Cut Back Asphalt are contained in a 36 treatment and bituminous surfacing with page data book. Standard Oil Co. of Indiana, 910 So. Michigan Ave., Chicago, Ill.

113. Complete and detailed specification sheets on Road Oil and Penetration Asphalts, furnished on request by the MacMillan Petroleum Corp., El Dorado, Arkansas.

114. Complete information concerning Alabama Asphaltic Limestone will be sent promptly on request to the Alabama Asphaltic Limestone Co., Liberty National Bldg., Birmingham, Ala.

Road Machinery

127. "Road Machinery Illustrated." New illustrated bulletins on the motor rollers, three-wheel and tandem rollers, motor graders powered by Caterpillar, Twin City, Cletrac, McCormick-Deering and Fordson tractors, and straight and leaning wheel graders. Galion Iron Works & Mfg. Co., Galion, O.

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2-33

Rollers

132. A 32-page book in four colors featuring a complete line of road rollers. 8¾ x 11, leatherette cover, numerous action pictures. Buffalo-Springfield Roller Co. of Springfield, Ohio.

133. 20-page pocket size booklet showing all types of Buffalo-Springfield motor rollers and scarifiers and their uses. The Buffalo-Springfield Roller Company, Springfield, Ohio.

134. "The Chief," a six cylinder roller of advanced design and construction is fully described in an illustrated catalog just issued by the Galion Iron Works & Mfg. Co., care of The Jeffrey Mfg. Co., Columbus, Ohio. Gives complete details of the very latest development by this company.

Sand and Gravel Washing Plants

140. Seventy-page catalog giving complete information regarding Sand and Gravel Washing Plants, stationary and portable. Those interested in such equipment should have a copy. Link-Belt Co., Chicago, Ill.

Shovels, Cranes and Excavators

144. Complete information including operating ranges of General Excavators is given in Bulletin No. 3105 recently prepared by The General Excavator Co., 365 Rose St., Marion, Ohio.

146. Link-Belt Co., Chicago, Ill., has issued Book No. 1095, which describes and illustrates their complete line of Gasoline, Electric, or Diesel operated shovels, cranes and draglines. 910 S. Mich. Ave.

Steel Posts

160. Steel Posts for highway guard rails, fences and other purposes. Catalog and data book. Sweet's Steel Company, Williamsport Pa.

Surveying Instruments

163. A complete catalog and instruction book pertaining to the "Sterling" transits and levels are described and illustrated in a 64-page booklet. Warren-Knight Co., 136 No. 12th St., Philadelphia, Pa.

164. Booklet on the most popular types of Transits and Levels in general use by Engineers and Surveyors, giving full information on the sizes and styles of these instruments. Issued by C. L. Berger and Sons, Inc., 37 Williams St., Boston 19, Mass.

Tires, Truck and Tractor

165. Speed and economy in use of solid, cushion and pneumatic tires and tubes for trucks, cars, tractors, graders and other road machinery. Government Sales Department of the Goodyear Tire & Rubber Company, Inc., Akron, Ohio.

Tool Boxes

167. Bulletin No. G-6 issued by Littleford Bros. 452 E. Pearl St., Cincinnati, Ohio, describes and illustrates the Han-DeeBox, a portable tool box of all-steel construction. This tool box is equipped with a special locking device that locks both covers at the same time. No padlocks are used. Littleford trailers, lead melting furnaces, and "Hot Dope" Kettles for pipe coating are also described in this bulletin.

Road and Street Maintenance

Asphalt Heaters

200. For general construction and maintenance, the Original Improved "Hotstuf" Asphalt Heater, an economical oil burning heater. Mohawk Asphalt Heater Co., 56 Weaver St., Schenectady, N. Y.

8. A 32-page general catalog issued by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio, describes and illustrates their complete road maintenance line, including tar and asphalt kettles, surface heaters, oil burners, sand dryers, tool boxes, lead and compound furnaces, tool heaters, asphalt tools, joint and crack fillers, squeegee carts, etc.

Distributors

206. Kinney distributors of from 600 to 1,700 gallon tank capacity with heating system and the Kinney jacketed pump having a capacity of over 400 gallons per minute are described in a new catalog just published by the Kinney Mfg. Co., 3529 Washington St., Boston, Mass.

207. Kinney Junior distributors in sizes from 350 to 600 gallons with smaller pumps and engines especially adapted for light trucks are described and illustrated in a new booklet just issued by the Kinney Mfg. Co., 3529 Washington St., Boston, Mass.

Dust Control

210. "How to Maintain Roads," by the Dow Chemical Company, Midland, Michigan, is a manual dealing thoroughly with dust control, road building and maintenance.

211. "Dust Control," a concise, handy pocket reference on control of dust by use of 3C Calcium Chloride. Illustrated. Issued by the Columbia Products Company, Barberton, Ohio.

212. "Wyandotte Calcium Chloride Prevents Dust the Natural Way."—a publication, fully illustrated, treating on Dust Control, economical road maintenance and methods of application, issued by the Michigan Alkali Company, 10 E. 40th St., New York City.

Dust Laying

213. Full information regarding the use of Solvay Calcium Chloride for effectively laying dust. The booklet, "Solvay Calcium Chloride, a Natural Dust Layer," 24 pages, 5½x8, covers application, economies, etc. Sent without cost. Solvay Sales Corporation, New York.

Emulsion Sprayers

214.—A complete line of emulsion sprayers is described in Bulletin No. G-5 recently issued by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio. Littleford Emulsion Sprayers will spray any type of asphalt emulsion used for penetration patch work or curing concrete. They are also used to spray silicate of soda and weed exterminators.

Surface Heaters

225. The "Hotstuf" three in one, combination Tool, Asphalt and Surface heater is described and its use illustrated in Bulletin 16. Mohawk Asphalt Heater Co., 56 Weaver St., Schenectady, N. Y.

Road and Paving Materials

Bituminous Materials

113. Complete and detailed specification sheets on Road Oil and Penetration Asphalts, furnished on request by the Macmillan Petroleum Corp., El Dorado, Arkansas.

227. "Asphalt for Every Purpose a 44-page illustrated booklet describing Stanolind Asphalt products. Standard Oil Co. of Indiana, 910 So. Michigan Ave., Chicago, Ill.

228. A new booklet has just been issued by The Barrett Co., 40 Rector St., New York, describing and illustrating the uses of each grade of Tarvia and Tarvialithic. 32 excellent illustrations.

229. A new series of concise and authoritative manuals of construction covering the latest developments in road-mix and surface treatment types as well as the standard asphalt pavements. These contain the best that has been developed by study, research and practical application in all types. Manual 1—Road-Mix Types is now ready for distribution. The Asphalt Institute, 801 Second Ave., New York, N. Y.

229A. Surface Treatment Types, Asphalt Road Construction Manual No. 2. Full details on surface treatments. 14 chapters, 128 pages. The second of those tremendously valuable and handy little manuals put out by the Asphalt Institute, 801 Second Avenue, N. Y. Sent on request.

Brick, Paving

230. Full information and data regarding the use of vitrified brick as a paving material, cost, method of laying, life, etc. National Paving Brick Manufacturers' Association, National Press Building, Washington, D. C.

Concrete Curing

235. "How to Cure Concrete," is a manual of instruction on the curing of concrete pavements. 47 pages. The Dow Chemical Company, Midland, Mich.

Gutters

240. "Brick gutters and Parking Strips." A study dealing with the problems faced in the proper construction of gutters and how they can be overcome. Covers design, construction and results. Well illustrated. Just issued by the National Paving Brick Ass'n, National Press Building, Washington, D. C.

Jacking Culverts

260. No interruption to traffic, and substantial savings in construction costs are the main advantages secured by using the Armco jacking method to install conduits, drainage openings, and passageways under streets, highways and railroads. "The Armco Jacking Method," describing this modern means of construction and its many applications, will be sent upon request, by Armco Culvert Mfrs. Association, Middletown, Ohio. Ask for Catalog No. 7.

Maintenance Materials and Methods

270. "How to Maintain Roads," by the Dow Chemical Company, Midland, Michigan, is a manual dealing thoroughly with road building, maintenance and dust control.

275. "Tarvia-K. P. for Cold Patching." An instructive booklet illustrating and describing each step in patching a road with Tarvia-K. P." 16 pages, illustrated, 3½x9. The Barrett Company, New York.

276. "Road Maintenance with Tarvia." A 56-page illustrated booklet of value to every road man. Shows how almost every type of road and pavement can be repaired and maintained with Tarvia. The Barrett Company, New York.

Snow Removal

Snow Fences

345. "Standard and Heavy Duty Reversible Blade Snow Plows for Motor Trucks," a new bulletin just published by the Monarch Mfg. Co., East Front St., Wilmington, Del. Illustrated. Contains complete descriptions and specifications.

346. "The Snow Removal Problem," by W. A. Olen, Pres. and Gen. Mgr., F. W. D. Auto Co., Clintonville, Wis., is a brief booklet which should interest all who are faced with the problem of snow removal. Contains suggestions for improving the efficiency of equipment, etc.

349. "The Answer to the Snow Removal Problem." It gives full details of the Frink type S snow plow for trucks. Carl Frink, Mfr. of Clayton, N. Y.

359. Galion Iron Works and Mfg. Co., Galion, Ohio. Details, prices and catalogs of their snow plows adaptable to any make of truck.

The A. R. B. A. and Road Show

The convention of the American Road Builders Association reflected in its attendance, as did the Road Show in the number of exhibits, the effect of the depression on the road construction industry. The number and length of reports and papers presented were not affected, however. The majority of these were committee reports, as listed in the program published on page 53 of our January issue. They embraced technical features of asphalt, brick and concrete pavement construction and maintenance, low-cost roads, emulsions, culverts, etc.; legislation, administration and finance, traffic, vehicle and gasoline taxes.

The committee on emulsified asphalts presented in attractive form the advantages of emulsions over cut-backs or other paving asphalts for road construction; but the committee on brick pavement stated that they are not generally satisfactory for fillers in such pavements, except where the filler must be applied in wet weather. The brick committee favored hard asphalt for filler, although there is greater difference of opinion on this than on any other feature of brick paving. Treating the tops of the bricks to prevent the filler adhering to them was the most recent development and received considerable attention.

Equipment for low-cost roads received the attention of five committees. Improvements in spreader boxes and revolving drums, pressure distributors, mechanical finishers, rollers and other equipment were described. Also improved equipment for spreading, vibrating and finishing concrete pavement.

The Road Show was held in the municipal airport, several miles from the convention hall. Although 121 manufacturers of equipment and materials occupied space, most of those supplying power shovels, concrete mixers and other large machinery showed photographs rather than the machines themselves. Judging from these and the descriptive literature, there had been few changes in 1932 other than in details, one of the most interesting of which was the substitution of push-buttons for levers for dumping trucks or operating more complicated machinery. Grader blades can be adjusted, the scarifier raised or lowered, the grader steered, all without muscular effort of the driver.

Equipment has been increased in size also. Six-yard scrapers, 12-yard wagons, 50 to 70 hp. diesel tractors, a retread mixer 24 ft. long by 12 ft. wide are among the examples of this.

Brick manufacturers brought forward a new idea—removing the air from the clay before burning it, making a denser and 4% heavier brick less porous and claimed to offer greater resistance to wear. Variations in treatment of bituminous materials to meet widely different conditions provide non-skid surfaces, adjust use to hot, cold or wet weather, etc., were offered by manufacturers of such materials.

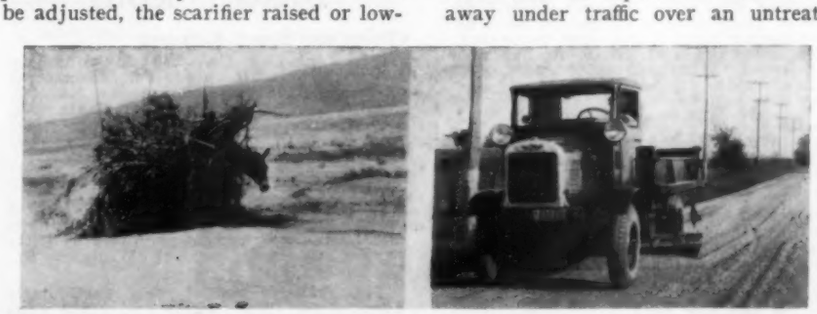
Concrete by Pipe Line is the title of a new booklet by Chain Belt Co. which tells how concrete with a slump as low as three inches, with aggregate up to 2½ inches can be pumped at the rate of 20 to 40 cubic yards an hour over any distance up to 500 feet or any height up to 75 feet. . . . *Rock Crushers* by the Monarch Manufacturing Co., along with elevators, conveyors, screens and washers, are described in Bulletin M-1½. Contains much technical data and dimensions.

Asphalt Road Construction Series Manual No. 2: Surface Treatment Types

In accordance with its plan to put out a complete series of concise manuals on asphalt road construction, The Asphalt Institute has just issued Manual No. 2 on "Surface Treatment Types." This manual, the result of a nation-wide study not only of method but of place of use, shows the best engineering practice in meeting every surface treatment requirement.

The importance of surface treatment studies is apparent, as it is estimated that of the million miles of highway to be eventually improved, over fifty percent can be permanently maintained by surface treatment at a lower net cost than by any other method. On many road locations it is actually cheaper in dollars and cents to surface treat than to replace material blown away under traffic over an untreated road. For further comment on the advantages on surface treatment attention is called to the manual Foreword entitled: "Dust! Mud!"

Copies of Manual No. 2 will be sent without charge upon request either to PUBLIC WORKS or to The Asphalt Institute, 801 Second Avenue, New York, N. Y., as you may prefer.



Old and new methods of road maintenance. Both have 4-point traction. On the left, the way roads are maintained in Palestine; on the right, the F. W. D. truck and scraper combination.

To Prevent Construction Accidents

Metal trench and excavation guards, intended to replace the old and ineffectual wooden barricade, have just been put on the market. A series of these will form a completely unbroken fence entirely around any shape of excavation or along any trench, as they swivel in any direction. A combination lantern and flag support is provided, insuring visibility and minimizing theft. These guards are made of rust-proofed malleable iron, and are economical because they prevent accidents and because they eliminate the replacement constantly necessary with the old type wooden horse. They are made by the Cleveland Trencher Co., Cleveland, O.

Cleveland trench-guard with lantern pinned in place.

For Concrete Curing

The Stedfast Mfg. Co., Mattapan, Boston, Mass., has developed what is called "Sta-Fast" for use in curing concrete pavements. It is a covering furnished in any desired width for application to freshly laid concrete. A cellular construction will, it is claimed, absorb and hold mechanically more than 95% of its weight in water, and when the air cells are filled with water evaporation is retarded.

By wetting "Sta-Fast" once in 24 hours constant moisture to the right degree will be maintained. It promotes uniformity in curing, is easy to handle. As a section is cured the covering is rolled up and placed on another and so on through a long life.

A folder issued by the company gives very complete information.

Index to Advertisements

When you want catalogs describing materials or equipment advertised in PUBLIC WORKS, refer to the classified INDUSTRIAL LITERATURE section beginning on page 47 and order by number.

Sanitary Engineering

Activated Carbon, Aqua NUCHAR

380. For low cost removal of tastes and odors from potable waters. Used by more than 300 municipalities. For literature address Industrial Chemical Sales Company, Inc., 230 Park Avenue, New York.

Ferric Chloride

381. Full information concerning the experiences in the use of ferric chloride for use in sludge conditioning and in coagulating sewage will be sent promptly by Innis, Speiden & Co., 117 Liberty St., New York, N. Y.

383. Loughlin Clarifying Tanks for the more complete removal of suspended solids from sewage and industrial wastes at lower cost are described in a new bulletin just issued by Filtration Equipment Co., 350 Madison Ave., New York, N. Y.

Fittings

385. "6 Reasons Why Dilform Compression Fittings and Copper Tubing Are Ideal." It is leakproof, does not corrode, no deformation, vibration proof, does not restrict flow, installation cost low. Write Bailey Meter Co., 1027 Ivanhoe Rd., Cleveland, Ohio, for the price list and bulletin.

Jointing Materials

401. G-K Compound for vitrified clay sewers, MINERALEAD for bell and spigot water mains, also M-D Cut-Ins for making house connections. Atlas Mineral Products Company, Mertztown, Pennsylvania.

402. Full details concerning No. 1 Korite for sealing sewer pipe joints so that they will be permanently tight. Standard Oil Co. of Indiana, 910 So. Michigan Ave., Chicago, Ill.

Manhole Covers and Inlets

404. Street, sewer and water castings made of wear-resisting chilled iron in various styles, sizes and weights. Manhole covers, water meter covers, adjustable curb inlets, gutter crossing plates, valve and lamphole covers, ventilators, etc. Described in catalog issued by South Bend Foundry Co., South Bend, Ind.

Meters, Sewage and Water

405. Just issued. Every sanitary engineer should have a copy of this new 32 page booklet describing the applications, types and distinctive features of the new Bailey meters for sewage treatment and water supply. Sent promptly. Bailey Meter Co., 1027 Ivanhoe Road, Cleveland, Ohio.

Pumping Engines

413. "When Power Is Down," gives recommendations of models for standby services for all power requirements. Sterling Engine Company, Buffalo, N. Y.

Screens, Sewage

417. The simple, automatic, Loughlin self-cleaning traveling screen is fully described in a new bulletin just issued by Filtration Equipment Co., 350 Madison Ave., New York, N. Y.

418. Sewage screens (Tark, Brunotte, and Straightline) for fine and coarse sewage; Straightline Collectors for Settling Tanks (Sludge, Scum and Grit), and Mechanical Aerators for activated sludge plants. Link Belt Company, 910 So. Michigan Ave., Chicago, Ill. Book 642.

419. An illustrated booklet showing installations, and complete details regarding the 19 exclusive improvements which are featured in Shevlin Fine Disc Screens will be sent promptly by the Shevlin Engineering Co., Inc., 227 Fulton St., New York, N. Y.

420. A useful new bulletin for all those interested in sewage disposal, describing some of their proven equipment such as self-cleaning bar screens, grit conveyors, sludge collectors and shredders, has just been issued by the Jeffrey Mfg. Co., Columbus, Ohio. Includes diagrams and many illustrations.

Screens

424. Water Screen Book No. 1252, describes water screens and gives complete technical information about them. Link-Belt Co., Chicago, Ill.

Sludge Bed Glass Covers

426. Sludge Bed Glass Covers—"Super-Frame" Hitchings & Co., Main Office, Elizabeth, New Jersey. Offer A. I. A. File 101SB, describing glass covers for sludge and sprinkler beds; details, specifications and cost data.

427. Bulletin GE31 describes Glass Enclosures for Sludge Beds in detail. Specifications, cross sections, details and illustrations shown are of value to engineers and officials. Sent promptly upon request. American-Moninger Greenhouse Mfg. Corp., Dept. B, 1947 Flushing Ave., Brooklyn, N. Y.

Sludge Conditioning

381. Full information concerning the experiences in the use of ferric chloride for use in sludge conditioning and in coagulating sewage will be sent promptly by Innis, Speiden & Co., 117 Liberty St., New York, N. Y.

Treatment

430. Separate bulletins showing their many lines of sewage treatment equipment will be sent promptly by The Pacific Flush Tank Co., Chicago and New York. The latest is No. 110 describing tray clarifiers.

433. Collectors and concentrators for modern sewage treatment plants, recent installations, and full data on aerators, and screens. Link Belt Co., 910 So. Michigan Ave., Chicago, Ill. and Philadelphia.

Water Development

440. Complete details of the Layne System of water development for municipalities and irrigation projects, based on deep wells and turbine pumps. Layne & Bowler, Memphis, Tenn.

Miscellaneous

Chains and Speed Reducers

607. Link-Belt Co., 910 So. Michigan Ave., Chicago, Ill., gives full description of its positive drives in books No. 125, Silent Chain; No. 1257, Roller Chain; No. 815, Herringbone Speed Reducers; No. 1050, Promal Chains. Send for these positive power transmission books.

Transits and Levels

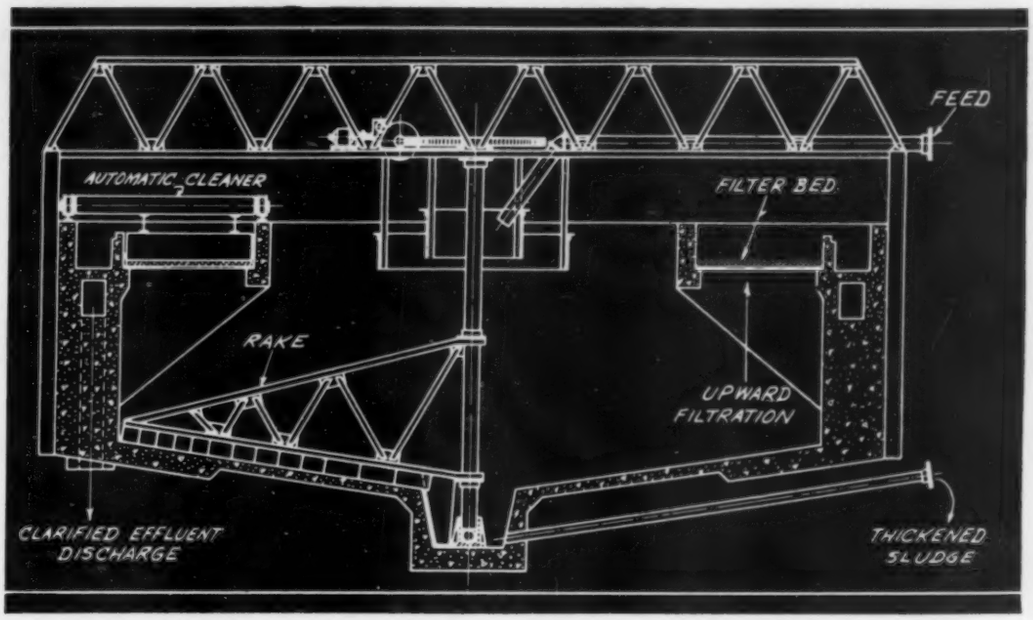
629. A booklet giving full information on the sizes and styles of Berger Transits and Levels will be sent promptly by C. L. Berger & Sons, Inc., 37 Williams St., Boston 19, Mass.

630. Transits and Levels particularly adapted for City, County and State work are described in a 64-page catalog. Warren-Knight Co., 136 No. 12th St., Philadelphia, Pa.

Wire Rope

634. Williamsport Wire Rope Co., Chicago, Ill., has issued a folder illustrating their new method of "preseating."

LAUGHLIN CLARIFYING TANK



Low Power and Low Operating Cost

More complete removal of suspended solids from sewage and industrial wastes is now possible through the use of the LAUGHLIN Clarifying Tank.

LAUGHLIN Clarifying Tanks permit of usual sedimentation and thickening operations within a tank, at high capacity for a given tank size.

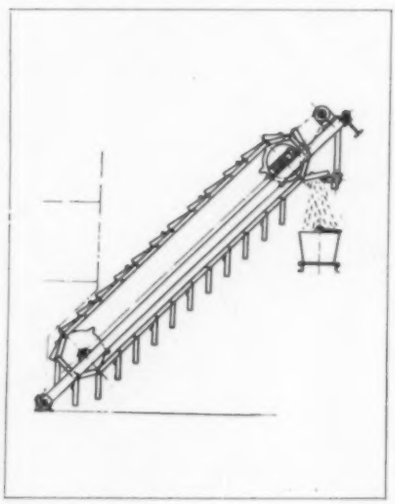
Solids are removed by positive filtration through a filter bed which extends around entire circumference of tank, extending inwardly five feet or more. The solids which do not settle from the containing fluid are removed therefrom by filtering upwardly through a bed of magnetite sand; in principle similar to that followed in the purification of municipal water supply, except that filtration may be either upward or downward.

A traveling magnet cleans the filter bed as necessary. Tanks are built round or rectangular for any given capacity, and power and operating costs are low.

FILTRATION EQUIPMENT CORPORATION

350 Madison Ave., New York

LAUGHLIN *Self-Cleaning* TRAVELING SCREEN



SIMPLE and AUTOMATIC

This traveling grate screen is adapted to sewage work as a trash rack or fine screen, or both in combination.

Rugged . . . Adjustable as to bar spacing . . . High capacity . . . Non-clogging . . . Self cleaning.

Low in first cost and efficient in operation.

For latest catalogs—consult the *classified* INDUSTRIAL LITERATURE section, beginning on page 47

Barrett Tarvia

GOOD ROADS at LOW COST

Route No. 20, Lucas County, Ohio. Tarvia-built, 1927

ALL road tars are not alike. There is a striking difference—in favor of Tarvia.

For Tarvia is made only by The Barrett Company, America's oldest and most-experienced manufacturer of coal-tar road-building materials. Barrett has many sources of crudes, and 29 years of manufacturing experience have taught Barrett chemists and engineers how to classify them and refine Tarvia in grades to meet every highway need. The Tarvia Barrett offers to meet users' specifications must first of all meet our own rigid, self-imposed specifications.

The result is a degree of uniformity and dependability in Tarvia which ordinary road tars do not duplicate. Experienced road engineers appreciate the difference because it helps them eliminate "guess-work." With Tarvia, plus the intelligent and unobtrusive advice and cooperation of skilled Tarvia field men, smooth, easy-riding, skid-safe roads are easy to build . . . and easy and economical to maintain.

Before completing your 1933 plans, ask the Tarvia field man to tell you more about the *plus-values* of Tarvia.

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